412306

ORIGINAL (Red)

DEPARTMENT OF THE ARMY
UNITED STATES ARMY RESEARCH LABORATORY
2800 POWDER MILL ROAD
ADELPHI, MARYLAND 20783-1197

REPLY TO THE ATTENTION OF

May 10, 1996

Risk Management Division

SUBJECT: Remedial Investigation (RI) at 500 Area, Adelphi Laboratory Center, Adelphi, MD

U.S. Environmental Protection Agency
Region III
ATTN: Mr. Denis Zielinski (3HW90)
841 Chestnut Street
Philadelphia, PA 19107

Dear Mr. Zielinski:

Please be advised that an environmental investigation is now underway at the U.S. Army Research Laboratory's Adelphi Laboratory Center (ALC). This investigation is intended to provide the Army with a better understanding of the nature, extent, and source of the contaminated groundwater plume that is now known to exist at the ALC's 500 Area. A copy of the "Final Work Plan, Remedial Investigation at 500 Area, Adelphi, Maryland" plus relevant correspondence to the Maryland Department of the Environment is enclosed for your reference.

With regard to the Final RCRA Facility Assessment Report that was prepared by A.T. Kearney, Inc. in December 1990, please be advised that this on-going investigation is being undertaken on a voluntary basis. It is our understanding that the ALC will be issued a Corrective Action Permit (CAP) at some time in the future. To the extent that our fiscal resources allow, it is our intent to take any and all appropriate actions that may be required by the CAP in advance of its issuance. The findings of this voluntary investigation at the 500 Area will be of value to the Army in the pursuit of this objective.

Your point-of-contact at the Adelphi Laboratory Center is Mr. Robert Craig, who may be reached telephonically at (301) 394-4511. Please contact Mr. Craig if you have any questions or comments on this matter.

Sincerely,

FOR: JEFFREY T. NELSON
Chief, Risk Management Division

Enclosures: as

Risk Management Division
SUBJECT: Remedial Investigation (RI) at 500 Area, Adelphi Laboratory Center, Adelphi, MD

Copies Furnished (w/o enclosures):

U.S. Environmental Protection Agency, Region III, ATTN: Ms. Yazmine Yap-Deffler (3HW71), 841 Chestnut Street, Philadelphia, PA 19107

Director, U.S. Army Research Laboratory, 2800 Powder Mill Road, Adelphi, MD 20783-1197
ATTN: AMSRL-OP-SD-IC (MAJ Westberg)
ATTN: AMSRL-OP-SD-RK (Mr. Mason/Mr. Feustle)

COPY

Risk Management Division
SUBJECT: Final Work Plan, Remedial Investigation (RI) at 500 Area, Adelphi Laboratory Center, Adelphi, MD

Copies Furnished:

U.S. Environmental Protection Agency, Region III, 841 Chestnut Street, Philadelphia, PA 19107
ATTN: Ms. Yazmine Yap-Deffler (3HW71) (w/enclosures)
ATTN: Mr. Denis Zielinski (3HW90) (w/enclosures)

U.S. Army Corps of Engineers, Baltimore District, (ATTN: CENAB-EN-HM, Mr. William Thayer) P.O. Box 1715, Baltimore, MD, 21203-1715 (w/o enclosures)

Director, U.S. Army Research Laboratory, 2800 Powder Mill Road, Adelphi, MD 20783-1197 (w/o enclosures)
ATTN: AMSRL-OP-SD-IC (MAJ Westberg)
ATTN: AMSRL-OP-SD-RK (Mr. Mason/Mr. Feustle)

COPY

DEPARTMENT OF THE ARMY
UNITED STATES ARMY RESEARCH LABORATORY
2800 POWDER MILL ROAD
ADELPHI, MARYLAND 20783-1197

REPLY TO
THE ATTENTION OF

May 10, 1996

Risk Management Division

SUBJECT: Final Work Plan, Remedial Investigation (RI) at 500 Area, Adelphi Laboratory Center, Adelphi, MD

Maryland Department of the Environment
Waste Management Administration
Federal/NPL/Superfund Division
ATTN: Ms. Patti Davis
2500 Broening Highway
Baltimore, MD 21224

Dear Ms. Davis:

Attached you will find two enclosures that have been prepared on our behalf by the Baltimore District, U.S. Army Corps of Engineers (CENAB). These enclosures have been prepared as a direct result of the comments that were provided to CENAB's Mr. William Thayer at our work plan review meeting that took place at Mr. Thayer's office on April 22, 1996.

The first enclosure is a response summary, showing how Mr. Thayer has responded to each of the comments provided to him on April 22nd. The second enclosure is the final version of the work plan for the Remedial Investigation. Please be advised that the on-site phase of the investigation is now scheduled to begin on Monday, May 13, 1996.

In closing, please understand that this office appreciates your personal involvement and the quick responsiveness of your agency in reviewing and commenting on the earlier draft version of this RI work plan. Your timely support has been critical in allowing this project to begin next week. Without your support, it would be impossible for us to accomplish this project during the short period that remains within the current Fiscal Year. Thank you.

Your point-of-contact at the Adelphi Laboratory Center is Mr. Robert Craig, who may be reached telephonically at (301) 394-4511. Please contact Mr. Craig if you have any questions or comments on this matter.

Sincerely,

FOR JEFFREY T. NELSON
Chief, Risk Management Division

Enclosures: as

US Army Corps
of Engineers
BALTIMORE DISTRICT

FINAL WORK PLAN

ADELPHI LABORATORY CENTER
REMEDIAL INVESTIGATION AT 500 AREA

ADELPHI, MARYLAND

Prepared by:
Engineering Division
U.S. Army Engineer District, Baltimore
10 South Howard Street
Baltimore, MD 21201

May 1996

US Army Corps
of Engineers
BALTIMORE DISTRICT

FINAL WORK PLAN

ADELPHI LABORATORY CENTER
REMEDIAL INVESTIGATION AT 500 AREA

ADELPHI, MARYLAND

Prepared by:
Engineering Division
U.S. Army Engineer District, Baltimore
10 South Howard Street
Baltimore, MD 21201

May 1996

Remedial Investigation at 500 Area
Adelphi Laboratory Center, Adelphi, MD

WORK PLAN

This work plan provides the rationale, objectives and procedures for a Remedial Investigation at the Building 500 Area of the Adelphi Laboratory Center located in Adelphi, Maryland.

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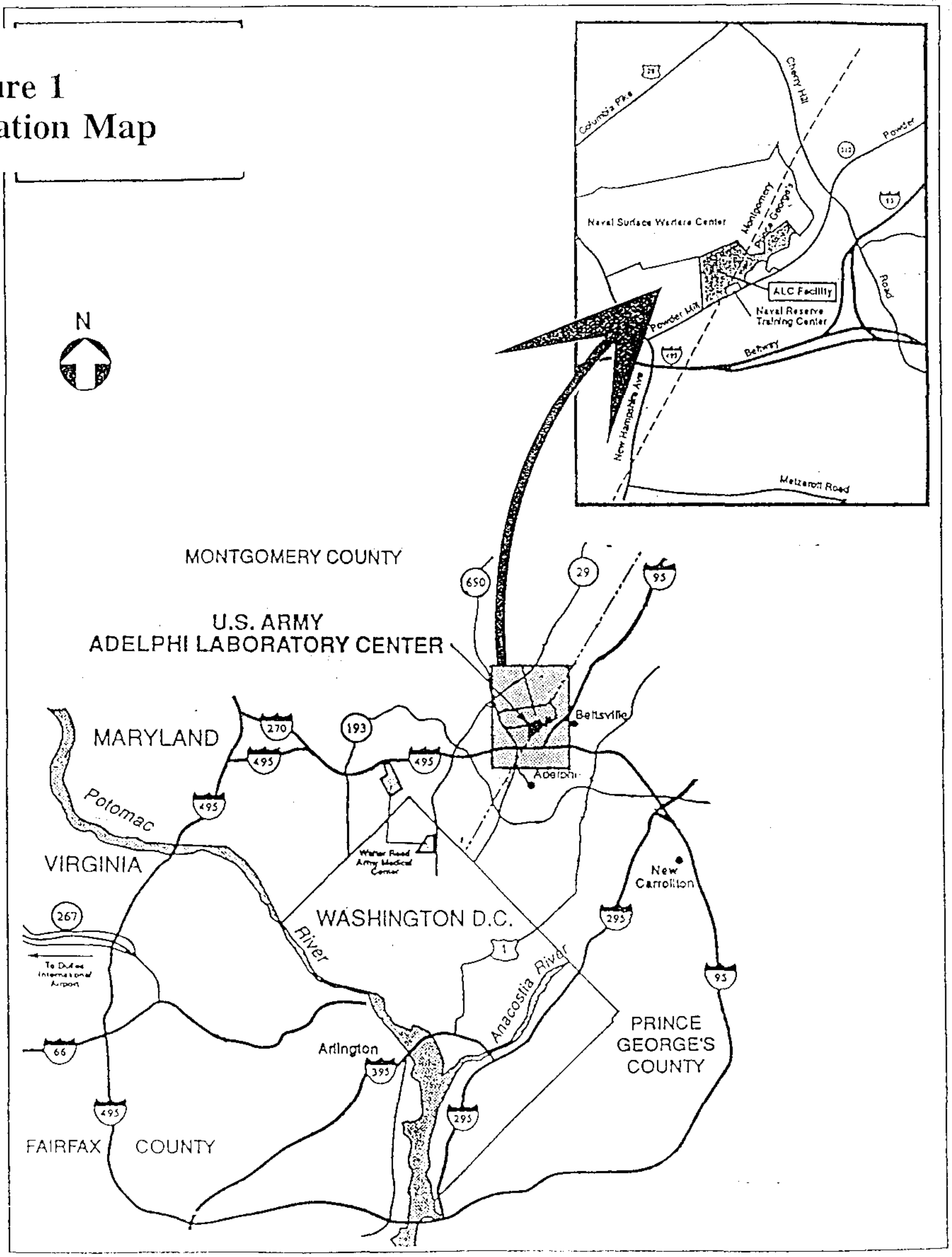
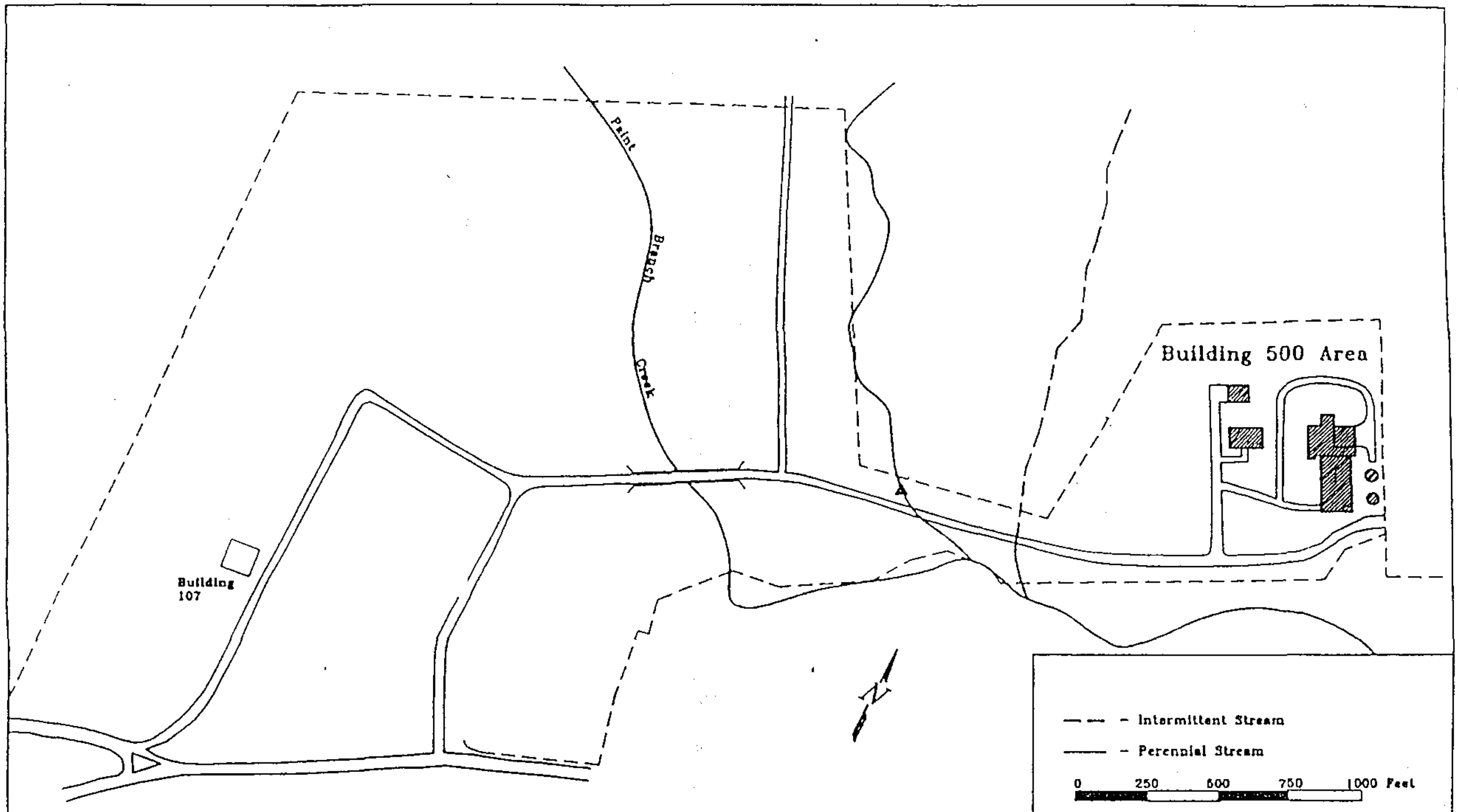
Location Map





US Army Corps of Engineers

ARMY RESEARCH LAB ADELPHI, MD
BLDG. 500 REMEDIAL INVESTIGATION

U.S. ARMY ENGINEER DISTRICT, BALT.
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

DATE: MA 1996

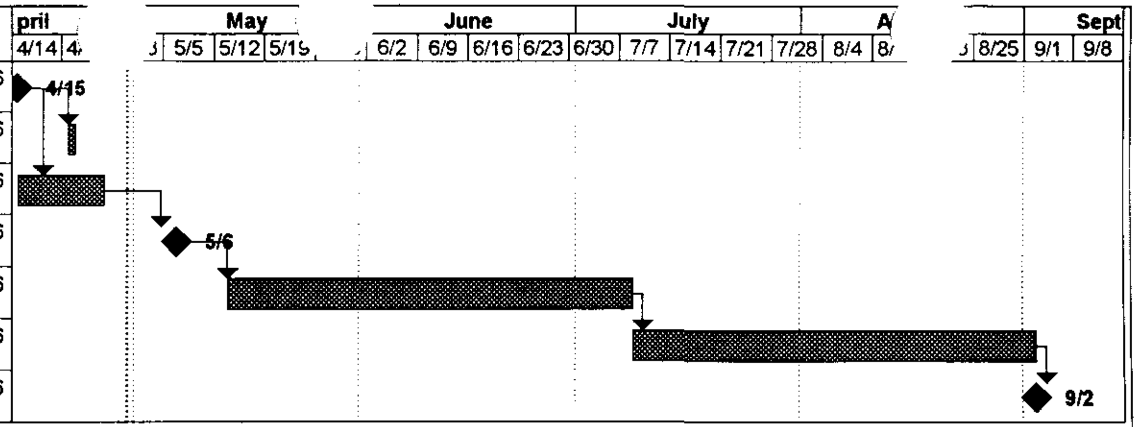
SCALE: AS SHOWN

SHEET:

Figure 2

Site Vicinity Map

ID	Task Name	Duration	Start	Finish
1	Distribute Draft Work Plan	0d	Mon 4/15/96	Mon 4/15/96
2	D. Work Plan Review Meeting	1d	Mon 4/22/96	Mon 4/22/96
3	Draft Work Plan Review	10d	Mon 4/15/96	Fri 4/26/96
4	Distribute Final Work Plan	0d	Mon 5/6/96	Mon 5/6/96
5	Perform Field Work	40d	Tue 5/14/96	Mon 7/8/96
6	Write Draft Report	40d	Tue 7/9/96	Mon 9/2/96
7	Distribute Draft Report	0d	Mon 9/2/96	Mon 9/2/96



Project: ALC Remedial Investigation
Date: Tue 4/30/96

Task | Summary | Rolled Up Progress
Progress | Rolled Up Task
Milestone | Rolled Up Milestone

Figure 3

US Army Corps
of Engineers
BALTIMORE DISTRICT

FINAL WORK MANAGEMENT PLAN

ADELPHI LABORATORY CENTER
REMEDIAL INVESTIGATION AT 500 AREA

ADELPHI, MARYLAND

Prepared by:
Engineering Division
U.S. Army Engineer District, Baltimore
10 South Howard Street
Baltimore, MD 21201

May 1996

Remedial Investigation at 500 Area
Adelphi Laboratory Center, Adelphi, MD

WORK MANAGEMENT PLAN

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1.0 PROJECT DESCRIPTION

1.1 Purpose and Scope

This document presents the Work Management Plan for the Remedial Investigation to be performed at the Army Research Laboratory's Adelphi Laboratory Center(ALC) located in Adelphi, MD. This plan explains the continuing investigation of potentially contaminated soil, groundwater, and surface water in the vicinity of building 500 at the ALC. The Baltimore District, U.S. Army Corps of Engineers will perform engineering services to characterize the nature, extent, direction, rate, movement, and concentration of hazardous waste and/or hazardous constituents at the facility.

The investigation will include the installation of groundwater monitoring and observation wells; sampling of the proposed and existing monitoring wells; collection and analysis of soil samples obtained from soil borings; collection and analysis of surficial soil samples; collection and analysis of surface water samples and the collection and analysis of sediment samples. The data will then be used to determine nature, extent and source(s) of contamination and potential future actions.

1.2 Previous Investigations

1.2.1 *Naval Surface Warfare Center*

In November of 1984, an Initial Assessment Study (IAS) Report at the adjacent Naval Surface Warfare Center (NSWC) concluded that seven of the 14 sites investigated at NSWC posed a potential threat to human health and the environment sufficient to warrant further study. The IAS was followed by a Verification Study, a Confirmation Study and a Phase I and II Remedial Investigation (RI-NSWC) (Malcolm Pirnie, 1992).

The RI addressed the seven sites identified in the IAS Report. Site 9 - Industrial Wastewater Disposal Area 300, is located uphill of the building 500 area and is a potential source of groundwater contamination in the building 500 area. Liquid wastes containing explosive compounds and solvents were discharged to the ground surface as well as to the subsurface via leaching wells. The RI report concluded that groundwater in the vicinity of Site 9 contained nitroaromatic compounds (HMX, RDX, 2,6-DNT, and nitrobenzene), trichloroethene (TCE) and low levels of dissolved metals. Groundwater flow direction was determined to be towards the south-southeast, towards the confluence of an intermittent stream and a perennial stream.

1.2.2 Building 500

The U.S. Army Environmental Hygiene Agency (USAEHA) performed an investigation of the potential groundwater and surface water contamination from building 500 and the NSWC (Geohydrologic Study No. 38-26-K106-94) (USAEHA-1994).

USAEHA was requested by ALC to investigate ground water and surface water contamination from two sources: the building 500 Area and NSWC. The USAEHA investigation included installing and sampling four ground water monitoring wells in the vicinity of building 500 and collecting surface water and sediment samples from six locations. Two rounds of field samples were collected; in May and September 1994. USAEHA concluded:

- Ground water flow was to the southwest in the building 500 area;
- Thallium, nickel, dichloromethane and TCE exceeded drinking water standards in at least one ground water sample collected in either May or September 1994. Petroleum hydrocarbons were detected at low levels in all ground water samples collected in May 1994 and in one (upgradient) sample collected in September 1994.
- An upgradient source of thallium, dichloromethane, TCE, nickel and petroleum hydrocarbons was suspected. The source of these groundwater contaminants is unknown.
- Explosive compounds (2,4,6-TNT and RDX) were detected in a surface water sample collected from a drainage swale on the east side of building 500 (S-1; designated as a "sump" by AEHA). Petroleum hydrocarbons were detected in a sediment sample collected from location S-1. AEHA concluded that location S-1 is a probable discharge point for ground water and that, based on topography, this location receives ground water and surface water discharge from the NSWC property. (Note that the "sump" was located on Navy property at the time of sampling in May 1994. As explained in Section 1.2.3, below, this "sump" is now located on Army property.)

Potential sources of contamination in the building 500 area include the NSWC Site 9 discussed above, two 890,000 gallon aboveground storage tanks that contain non-PCB transformer oil located on the east side of building 500, three underground storage tanks located on the south sides of buildings 504 and 505, an oil/water separator located on the south side of building 500, past spills of non-PCB transformer oil in building 500, or perhaps an unidentified hazardous waste disposal area located to the east or northeast of building 500 on either Army or Navy property.

1.2.3 Site W

ALC recently acquired property east of building 500 from NSWC that is referred to as Site W. As part of the property transfer process an initial investigation was performed by the Army Corps of Engineers, Baltimore District. Subsequently, a Preliminary Assessment (PA) of the area was performed (Plexus Engineering Group, 1995). Analysis of soil samples collected by the Army Corps of Engineers, Baltimore District indicated the presence of heavy oil and trace amounts of barium and chromium. Analysis of soil samples collected during the PA indicated the presence of TCLP metals (barium, chromium and lead) and PCBs below regulatory levels. DDE and DDT were detected at low levels from an upgradient sample location. Explosives and TPH were not detected in any samples. It should be noted that NSWC operates a hazardous waste storage facility (building 700) adjacent to Site W.

1.2.4 Blowdown Area (Area of Concern C)

A Resource Conservation and Recovery Act Facility Assessment (RFA) was performed for ALC (formerly Harry Diamond Laboratories) in 1989-1990 (A.T. Kearney, Inc., 1990). The U.S. Army Environmental Hygiene Agency (USAEHA) performed an evaluation of the solid waste management units at the facility (Groundwater Quality Survey No. 38-26-KF66-92) (USAEHA-1992).

During the visual site inspection phase of the RFA, an approximately three feet by five feet soil stain was observed on the northeast side of building 500. The stain apparently was caused by the discharge of pump oil from a vacuum system bleed-off. The RFA suggested soil samples be collected and analyzed to determine the nature and extent of contamination.

1.2.5 [redacted] Well

A private domestic water supply well owned by Mr. [redacted] is located approximately [redacted] of building 500. The well was sampled by NSWC personnel in May 1994 and analyzed for total petroleum hydrocarbons. The well was sampled concurrently in September 1994 by AEHA and NSWC. Contaminants were not detected in any of the samples (AEHA 1994).

1.3 Statement of Work

Field work for this project is divided into 8 tasks. The task divisions are primarily for the purpose of managing the work. Descriptions of the tasks are outlined below.

1.3.1 Task 1 - Monitoring Well Drilling and Installation

Task 1 will include the drilling and installation of eight groundwater monitoring wells and two water observation wells, logging of soil and rock encountered during the drilling, measurement of groundwater levels, slug testing and permeability testing. Well locations are shown in Figure 1. The field procedures for this Task are detailed in Section 4.1 of the FSP. Task 1 field activities are summarized as follows:

1.3.1.1 Installation Groundwater Monitoring Wells Outside Bldg. 500

Installation of five (5) two-inch diameter groundwater monitoring wells (C-5, C-6, C-7, C-8, C-12). All five wells will be located outside of Bldg. 500. All five wells will be installed in a manner so that approximately 15 feet of the 20 foot well screen will straddle the watertable. These wells may straddle the overburden/bedrock interface if the watertable is within 15 feet of the top of the bedrock surface.

1.3.1.2 Installation Groundwater Monitoring Wells Inside Bldg. 500

Installation of two (2) two-inch diameter groundwater monitoring wells (C13 and C-14). Both wells will be installed inside Bldg. 500 and completed as flushmount wells. Both wells will have approximately a two foot riser casing and an eight foot screen section. It is anticipated that groundwater will be encountered directly below the concrete floor subgrade. Both wells will be installed in such a manner that the well screen straddles the watertable. These wells may straddle the overburden/bedrock interface.

1.3.1.3 Installation of Deep Bedrock Well

Installation of one (1) two-inch diameter deep bedrock groundwater monitoring well (C-11). This well will be located adjacent to existing well A-4. The bedrock well will be constructed so that the entire well screen is located in the bedrock.

1.3.1.4 Installation of Water Observation Wells

Installation of two (2) one-inch diameter water observation wells (C-9 and C-10). Both of these wells will be installed in a manner so that approximately 15 feet of the 20 foot well screen will straddle the watertable. These wells may straddle the overburden/bedrock interface if the watertable is within 15 feet of the top of the bedrock surface.

1.3.1.5 Field Permeability and Slug Testing

One one-inch diameter water observation well will be selected for insitu permeability testing (C-9). Testing will provide a vertical profile of permeability values. Slug tests will be performed on six wells to estimate values of hydraulic conductivity (C-5, C-6, C-7, C-8, C-12 and C-13).

1.3.1.6 Lithologic Sampling and Logging

Lithologic samples and rock core will collected and described in the field to define local geologic conditions.

1.3.1.7 Geotechnical Sampling

A total of eight soil samples will be sent to the geotechnical laboratory for physical parameters testing. The geotechnical samples will be collected from each of the five (5) two-inch diameter groundwater monitoring wells located outside of Bldg. 500 (C-5, C-6, C-7, C-8, C-12), the (2) one-inch diameter water observation wells (C-9 and C-10) and the one (1) deep bedrock groundwater monitoring well (C-11).

1.3.2 Task 2 - Soil Borings

Task 2 will include the drilling of four soil borings located adjacent to the oil water separator and underground storage tanks (USTs), collection of soil samples for chemical testing from the four borings and logging and screening of soil encountered during the drilling. Boring locations are shown in Figure 1. The field procedures for this Task are detailed in Section 4.2 of the FSP. Task 2 field activities are summarized as follows:

1.3.2.1 Location of Soil Borings

Four soil borings will be drilled in the vicinity of potential sources of soil and groundwater contamination in the building 500 area. Borings will be drilled in the vicinity of the oil water separator (TB-1), the 1,000 gallon UST near building 504 (TB-2), the 3,000 gallon UST near building 504 (TB-3) and the 550 gallon UST near building 550 (TB-4).

1.3.2.2 Soil Sampling

Split spoon samples will be collected continuously from the ground surface until the water table is encountered.

1.3.2.3 Field Screening

Soil samples will be logged and screened using a PID with a 11.7 eV bulb to determine if volatile organic contamination is likely to be present.

1.3.2.4 Selection of Soil Samples for Laboratory Analysis

The one soil sample from each boring that exhibits the highest PID reading will be sent to the laboratory for chemical analysis. Otherwise, the soil sample closest to the water table will be sent to the laboratory for chemical analysis.

1.3.3 Task 3: Ground Water Sampling

Groundwater samples for laboratory chemical analysis will be collected from the eight newly installed two-inch diameter groundwater monitoring wells (C-5, C-6, C-7, C-8, C-11, C-12 , C-13 and C-14), four existing monitoring wells installed by AEHA (A-1, A-2, A-3, A-4) and two domestic water wells owned by [redacted] and [redacted] No groundwater samples will be collected from the two newly installed one-inch water observation wells (C-9 and C-10). Groundwater samples will be analyzed for VOCs (EPA METHOD 8260), TAL Metals (filtered and unfiltered), SVOC (EPA 8270), Pesticides and PCB (EPA 8081) and explosive compounds (EPA Method 8330).

1.2.4 Task 4 - Blowdown Area (Area of Concern C) Soil Sampling

The blowdown area is located directly beneath the vacuum system bleed-off on the east side of building 500. A soil sample will be collected to determine the nature and extent of contamination present. The soil sample will be collected with a hand auger from 0-24-inches below the ground surface. The sample will be analyzed for VOCs (EPA Method 8260) and SVOCs (EPA Method 8270).

1.3.5 Task 5: Floor Drain Sampling

A water sample will be collected from the sump inside the building and the drainage system discharge point on the southeast side of building 500. Samples will be collected at high and low flow periods for a total of four samples. The samples will be analyzed for VOCs (EPA METHOD 8260), SVOCs (EPA METHOD 8270), TAL Metals (filtered and unfiltered), Pesticides and PCB (EPA 8081), and explosive compounds (EPA Method 8330).

1.3.6 Task 6: Site W drainage Swale

Surface water and sediment samples shall be collected from two locations of the Site W drainage swale. Samples locations will be based on previous field work described in Section 1.2.3. In addition, one surface water and sediment sample will be collected from the stream that receives the discharge from the oil/water separator located at building 500. The samples will be analyzed for VOCs (EPA Method 8260), SVOCs (EPA Method 8270), TAL metals unfiltered), Pesticides and PCB (EPA Method 8081), and explosive compounds (EPA Method 8330).

1.3.7: Task 7: [redacted] and [redacted] Wells

A record search will be conducted of the [redacted] and [redacted] wells to determine the wells' characteristics including well depth, water table depth, well capacity, and daily usage.

1.3.8: Task 8: Investigation Derived Waste Management

Investigation Derived Waste (IDW) shall include drill cuttings, well development water, well purge water generated during sampling and personnel protective equipment used during the investigation.
In keeping with the USEPA publication 9345.3-03FS, "Guide to the Management of Investigation-Derived Wastes", to minimize the generation and handling of waste material IDW that does not appear contaminated (based on odor, visual observation and PID readings) will not be containerized. Soil cuttings that do not appear contaminated will be spread out on the ground surface adjacent to the borehole. Purge and development water that does not appear to be contaminated (e.g. no sheen) shall be discharged to the ground surface. However, this IDW water shall not be discharged within 50 feet of a well.

IDW that appears to be contaminated will be placed in 55-gal DOT-approved drums. The following information will be marked on the drums:

- Generator: ALC, Adelphi, MD
- Specific Origin: For example: Monitor Well/Soil Boring Number(s)
- Waste Description: For Example: Soil cuttings; purge water
- Generation Date

Containerized waste will be analyzed in accordance with local, state and federal regulations, as a minimum. In addition the waste will be analyzed in accordance with the requirements of the waste transporter and treatment, storage and disposal facility. Analytical results of groundwater samples will be used to determine the proper method of handling the containerized purge and development water. Composite samples of containerized soil cuttings will be analyzed in accordance with applicable regulations, as discussed above. To facilitate accurate characterization of waste, contaminated IDW will not be mixed; i.e.: contaminated IDW from one soil boring/monitoring well will not be mixed with IDW from another soil boring/monitoring well. Aqueous and solid IDW will not be mixed.

1.4 Objectives

The overall objective of this investigation is to determine the nature, extent and source(s) of contamination present in groundwater in the building 500 area. This information will be used to determine if any additional action is warranted at the site. Possible future actions include performing one or more of the following: risk assessment, feasibility study, remedial design and interim remedial action.

Task-specific objectives and rationale for proposed field work are provided below.

1.4.1 Task 1: Monitoring Well Drilling and Installation

There is insufficient data to accurately characterize the hydrogeology and the nature, extent and source(s) of groundwater contamination in the building 500 area. Information obtained from drilling, installing and sampling the proposed wells will provide the information necessary to fill in the existing data gaps.

1.4.2 Task 2: Soil Borings

Soil borings are proposed next to three existing underground storage tanks (USTs) and an oil/water separator (o/w/s). The soil borings will determine if the USTs or o/w/s are sources of contamination.

1.4.3 Task 3: Groundwater Sampling

See Section 1.4.1.

1.4.4 Task 4: Blowdown Area (Area of Concern C)

The RFA (A.T. Kearney, Inc. 1990) identified the blowdown area as an area of concern and suggested soil samples be collected to determine the nature and extent of contamination present. Analysis of the soil samples proposed in this investigation will provide the information necessary to determine if any further action is required. This is a very small site. It is anticipated that future action, if any, will consist of containerizing contaminated soil in one or two 55 gallon drums and disposing of the drums in accordance with the analytical results.

1.4.5 Task 5: Floor Drain Sampling

Samples will be collected from the floor drain to provide data on the nature and extent of contamination present beneath the building slab. The data will assist in determining if past spills are a source of contamination as well as contribute to the understanding of the nature and extent of groundwater contamination at the site.

1.4.6: Task 6: Site W Drainage Swale Sampling

The objective is to determine if Site W is a source of contamination. Existing data is inconclusive. The proposed sampling effort will provide data necessary to fill the existing data gap. Likewise, the sampling effort proposed for the stream that receives the oil/water separator discharge will produce data that will be used to determine wether or not contaminants are present in the stream water or sediments.

1.4.7 Task 7: [redacted] and [redacted] Wells

Existing groundwater elevation data indicates the [redacted] and [redacted] wells may be downgradient of the building 500 area. Previous sampling of the [redacted] well indicated that contamination was not present. However, groundwater contamination was detected on ALC property (USAEHA, 1994). Additional sampling of the [redacted] and [redacted] wells is warranted to ensure contaminants are not present.

In addition, a record search will be performed to determine well construction information. Well construction data will assist in evaluating the groundwater quality information obtained from the analysis of the well samples. For example, well construction information, if suitable, will be used to determine which aquifer(s) provide water to the wells.

1.4.8 Task 8: Investigation Derived Waste Management

This task does not directly contribute to satisfying project objectives.

2.0 PROJECT MANAGEMENT

2.1 Activities

BCOE has been authorized to perform the activities described within the Work Management Plan (WMP), Field Sampling Plan (FSP), Site-Specific Safety and Health Plan (SSHP), and the Quality Assurance Project Plan (QAPP).

All field work will be performed by the Baltimore District, U.S. Army Corps of Engineers. The geotechnical drilling and sampling for the project will be performed by the Baltimore District's Field Exploration Unit, Geology and Investigations Section (BCOE-FEU).

Analytical testing will be performed by Chemron, Inc., San Antonio, Texas.

Quality assurance testing will be provided by New England Division Environmental Laboratory, U.S. Army Corps of Engineers.

2.2 Personnel

The organizational structure and responsibilities are designed to ensure adequate project control and proper quality assurance for the field program at ALC.

ALC Primary POC: Robert P. Craig, P.E., Environmental Engineer, Risk Management Division.
(301) 394-4511

ALC Alternate POC: John Feustle, Environmental Engineer, Risk Management Division.
(301) 394-4511

Key Baltimore District personnel and their responsibilities are provided below:

Project Manager CENAB-EN-PP-E	Mr. Khal Masoud (410) 962-4448
Design Manager CENAB-EN-HM	Mr. William Thayer (410) 962-6121
Project Hydrogeologist CENAB-EN-GG	Mr. James Spratt (410) 962-6641
Project Geologist CENAB-EN-GG	Ms. Michelle Brock (410) 962-6649
Project Environmental Engineer CENAB-EN-HT	Mr. Gary Schilling (410) 962-3134
Quality Assurance Officer CENAB-EN-HI	Mr. Robert Miller (410) 962-6744
Health and Safety Officer CENAB-EN-HI	Mr. Maurice Wooden (410) 962-6740

Site Safety Officer (SSO) CENAB-EN-HT	Mr. Clint Kneten (410) 962-6743 (410) 962-7680 (mobile)
Field Geologists CENAB-EN-GG	Mr. Lyle Griffith/ Mr. Andrejs Dimbirs (410) 962-4044 (410) 370-1348
Chief, Field Exploration Unit CENAB-EN-GGE	Mr. Bill Kriner (410) 962-4044
Sampling Personnel CENAB-EN-HT	Ken Hilton/Sarah Streeter/Clint Kneten (410) 962-4375/3631/6743

2.3 Responsibilities

Project Manager
- Primary liaison with ALC for project funding and schedule.
- CENAB POC for ALC Installation Restoration Program.
- Notifies ALC POC of changes that may affect the quantity or quality of generated data or costs.

Design Manager
- Liaison with ALC on technical issues.
- Tracks project costs and schedule.
- Ensures project objectives developed by ALC/CENAB are met.
- Coordinates CENAB team.
- Notifies Project Manager of field changes that may affect the quantity or quality of generated data or costs.

Project Hydrogeologist
- Responsible for coordinating all geotechnical branch activity during the project.
- Develops field investigation program that meets the project objectives.

Project Geologist
- Responsible for the preparation of the FSP, WMP, drilling instructions and RI report.
- Coordinates between geotechnical personnel in the office and field.
- Responsible for verifying that field work complies with WMP and FSP.
- Notifies Design Manager of field changes that may affect the quantity or quality of generated data or costs.

Environmental Engineer
- Responsible for coordinating all Remedial Investigation and Design (RID) section activity.
- Provides guidance in all areas related to environmental and chemical engineering.

Quality Assurance Officer
- Develops and implements the Quality Assurance Project Plan.

- Coordinates with analytical chemistry laboratories (QA and QC) and reviews laboratory reports.

Health & Safety Officer
- Prepares and coordinates health and safety plan (SSHP).
- Supplies input for specific health and safety problems which may arise during operations.
- Provides oversight of SSO activities.
- Conducts specialized training as required.

Site Safety Officer
- Enforces the SSHP.
- Ensures required safety equipment is on-site, clean and operable.
- Revises equipment requirements or procedures based on new information.
- Coordinates emergency medical response.
- Designates rescue team for supplied air operations.
- Monitors personnel exposures/stress.
- Notifies appropriate emergency personnel in event of accident, fire or explosion.
- Has the authority to cease any operations not in compliance with the SSHP, or which threatens the health or safety of on-site personnel or the general public, or may cause significant adverse impact to the environment.
- Maintains field log containing weather conditions, instrumentation calibration documentation, records of air monitoring and personnel exposure data and other information as required.

Field Geologist
- Directs drilling procedures.
- Prepares drilling logs.
- Establishes and marks site boundaries.
- Coordinates access and security on site.
- Selects the type of drilling equipment and practices to be used.
- Directs drilling procedure.
- Responsible for collecting representative field data and recordkeeping of field activities, describing samples, packaging an shipping samples.
- Notifies Chief, Field Exploration Unit of field changes that may affect the quantity or quality of generated data or costs.

Chief, Field Exploration Unit
- Responsible for coordination of field drilling activities.
- Selects qualified personnel for field team.
- Notifies Project Geologist of field changes that may affect the quantity or quality of generated data or costs.

Sampling Personnel
- Responsible for collecting representative field data and record keeping of field activities.
- Comply with the FSP and SSHP.
- Report unsafe working conditions.

3.0 PROJECT LOCATION AND DESCRIPTION

The project area is the building 500 area of Adelphi Laboratory Center (ALC) in Adelphi, Maryland. The ALC is located approximately 5 miles northeast of the Washington, D.C. city limits. The installation covers approximately 159 acres of Prince George's and Montgomery Counties. Approximately 83 acres of the ALC are located in Montgomery County and 76 acres are located in Prince George's County. The RI focuses on the Buiding 500 area shown in Figure 1.

4.0 ENVIRONMENTAL SETTING

4.1 Topography

The topography is gently rolling to hilly with rock outcroppings. Elevations range from approximately 135 to 320 feet above sea level. Slopes range from 2 to 4 percent. The installation is drained by Paint Branch Creek, which flows across the area in a southeasterly direction. A small unnamed tributary flows from the west into Paint Branch Creek. Portions of the installation are heavily wooded.

4.2 Site Geology

The site lies within the Coastal Plain physiographic province, just to the east of the Fall Line which divides the Coastal Plain Province from the Piedmont. Geologic maps of the area indicate the site is underlain by Upland Gravel deposits of Pleistocene geologic age. The Pleistocene deposits overlie Cretaceous age soils belonging to the Potomac Group. The Cretaceous soils form the base of the Coastal Plain formations and directly overlie the bedrock formations that outcrop to the west of the Fall Line.

The topography of the site is hilly, with the younger geologic materials capping the high ground areas of the site. Erosion along the stream valleys has cut through the Pleistocene and Cretaceous age materials exposing the underlying bedrock and deeply weathered residual materials along the swales and stream valleys.

The bedrock beneath the site is believed to be a gneiss, belonging to the Wissahickon Formation, a metamorphic rock of early Paleozoic age. The bedrock is typically deeply weathered where exposed and is blanketed by a mantle of residual soils. The residual soils which develop from the in-place weathering of the parent bedrock are typically low plasticity silty sand to sandy silt that become denser, and grade into rock with depth. Harder portions of the residual soils are classified as disintegrated rock and posses characteristics of soft rock. Regionally, foliation within the bedrock strikes northward and generally dips to the west at 50 to 60 degrees.

4.3 Hydrogeologic Conditions

Groundwater within the region occurs under unconfined or water table conditions. The various geologic strata underlying the site serve as one interconnected aquifer with the groundwater surface forming a subdued reflection of the surface topography. Within the residual soils and Coastal Plain deposits, groundwater occurs within the pore spaces within the soil (primary porosity). Within the bedrock there are no pore spaces within the rock matrix and groundwater occurs within the fractures (secondary porosity). Semiconfined conditions sometimes occur along the bedrock fractures.

Permeability with the Coastal Plain deposits is typically anisotropic, and is usually greater in the horizontal direction than in the vertical direction as a function of depositional features. Within the residual soils, permeability is also anisotropic and shows higher permeability parallel to the strike of the foliation. As a function of weathering, permeability within the residual soils also increases with depth and reaches a maximum near the bedrock-soil interface. Permeability within the bedrock decreases with depth as fracture spacing tends to increase and joints become tighter with depth. The thickness of the bedrock aquifer is ill-defined. Water bearing fractures may occur at depths of 300 feet or greater, but the bulk of the groundwater flow typically occurs in the upper 50 to 100 feet of highly to moderately fractured bedrock.

Flow pathways within the bedrock are tortuous on a small scale (tens of feet). However, on a somewhat larger scale, flow through the bedrock (and contaminant transport) is topographically controlled and is analogous to flow through a porous medium.

5.0 APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS

Listed below are the applicable relevant and appropriate requirements which will govern the work effort at this site.

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 260-280	Resource Conservation and Recovery Act
40 CFR 300	National Contingency Plan
40 CFR 300.430	Comprehensive Environmental Response, Compensation, and Liability Act
40 CFR 300 (Subpart E)	Hazardous Substance Response
40 CFR 1500-8	National Environmental Policy Act (NEPA)

6.0 REFERENCES

Kearney/Centaur Division, A.T. Kearney, Inc., "Final RCRA Facility Assessment Report of Harry Diamond Laboratories, Adelphi, Maryland, EPA I.D. No. MD8213822762"; December 1990.

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New Jersey Department of Environmental Protection and Energy, "Field Sampling Procedures Manual"; May 1992.

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U.S. Army Center for Health Promotion and Preventive Medicine, "Phase 2 Geohydrologic Study No. 38-26-K106-94, U.S. Army Adelphi Laboratory Center, Adelphi, MD"; 20-21 September 1994.

U.S. Army Corps of Engineers, Washington, D.C., EM 200-1-3; Requirements for the Preparation of Sampling and Analysis Plans; 1 September 1994.

U.S. Army Corps of Engineers, Washington, D.C., EM 1110-1-4000; Monitor Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites"; 31 August 1994.

U.S. Army Environmental Hygiene Agency, "Phase 2, Geohydrologic Study No. 38-26-K106-94, U.S. Army Adelphi Laboratory Center, Adelphi, MD"; 20-21 September 1994.

U.S. Environmental Protection Agency, Publication: 9345.3-03FS, "Guide to Management of Investigation-Derived Wastes"; April 1992.

FIGURES

US Army Corps
of Engineers
BALTIMORE DISTRICT

FINAL FIELD SAMPLING PLAN

ADELPHI LABORATORY CENTER
REMEDIAL INVESTIGATION AT 500 AREA

ADELPHI, MARYLAND

Prepared by:
Engineering Division
U.S. Army Engineer District, Baltimore
10 South Howard Street
Baltimore, MD 21201

May 1996

US Army Corps
of Engineers
BALTIMORE DISTRICT

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Remedial Investigation at 500 Area
Adelphi Laboratory Center, Adelphi, MD

FIELD SAMPLING PLAN

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Appendix

1.0 Project Description

This document presents the Field Sampling Plan for the Remedial Investigation to be performed at the building 500 area at the Adelphi Laboratory Center (ALC) in Adelphi, MD. This plan explains the continuing investigation of potentially contaminated soil, groundwater, and surface water in the vicinity of building 500 at ALC. The Baltimore District, U.S. Army Corps of Engineers will perform engineering services to characterize the nature, extent, direction, rate, movement, and concentration of hazardous waste and/or hazardous constituents at the facility.

The investigation will include the installation of groundwater monitoring and observation wells; sampling of the proposed and existing monitoring wells; collection and analysis of soil samples obtained from soil borings; collection and analysis of surface water samples and the collection and analysis of sediment samples. The data will then be used to determine nature, extent and source(s) of contamination and potential future actions.

1.1 Site History and Contaminants

The Adelphi Laboratory Center (ALC) is located in Maryland approximately 5 miles northeast of the Washington DC city limits. The installation covers approximately 159 acres of Prince George's and Montgomery Counties. Approximately 83 acres of ALC are located in Montgomery County and 76 acres are located in Prince George's County. The ALC develops electronic fuses for projectiles, missiles and associated technology. ALC has performed research on fluidics and nuclear weapons effects technologies. Operations which support this mission have included metals plating, an impulse generator photographic operations, and production of printed circuit boards. All operations are on a small test scale and wastes are generally generated in small quantities. Additionally the installation has multiple support activities.

1.2 Previous Investigations

1.2.1 Naval Surface Warfare Center

In November of 1984, an Initial Assessment Study (IAS) Report at the adjacent Naval Surface Warfare Center (NSWC) concluded that seven of the 14 sites investigated at NSWC posed a potential threat to human health and the environment sufficient to warrant further study. The IAS was followed by a Verification Study, a Confirmation Study and a Phase I and II Remedial Investigation (RI-NSWC) (Malcolm Pirnie, 1992).

The RI addressed the seven sites identified in the IAS Report. Site 9 - Industrial Wastewater Disposal Area 300, is located uphill of the building 500 area and is a potential source of groundwater contamination in the building 500 area. Liquid wastes containing explosive compounds and solvents were discharged to the ground surface as well as to the subsurface via leaching wells. The RI report concluded that groundwater in the vicinity of Site 9 contained nitroaromatic compounds (HMX, RDX, 2,6-DNT, and nitrobenzene), trichloroethene (TCE) and low levels of dissolved metals. Groundwater flow direction was determined to be towards the south-southeast, towards the confluence of an intermittent stream and a perennial stream.

1.2.2 Building 500

The U.S. Army Environmental Hygiene Agency (USAEHA) performed an investigation of the potential groundwater and surface water contamination from building 500 and the NSWC (Geohydrologic Study No. 38-26-K106-94) (USAEHA-1994).

USAEHA was requested by ALC to investigate ground water and surface water contamination from two sources: the building 500 Area and NSWC. The USAEHA investigation included installing and sampling four ground water monitoring wells in the vicinity of building 500 and collecting surface water and sediment samples from six locations. Two rounds of field samples were collected; in May and September 1994. USAEHA concluded:

- Ground water flow was to the southwest in the building 500 area;
- Thallium, nickel, dichloromethane and TCE exceeded drinking water standards in at least one ground water sample collected in either May or September 1994. Petroleum hydrocarbons were detected at low levels in all ground water samples collected in May 1994 and in one (upgradient) sample collected in September 1994.
- An upgradient source of thallium, dichloromethane, TCE, nickel and petroleum hydrocarbons was suspected. The source of these groundwater contaminants is unknown.
- Explosive compounds (2,4,6-TNT and RDX) were detected in a surface water sample collected from a drainage swale on the east side of building 500 (S-1; designated as a "sump" by AEHA). Petroleum hydrocarbons were detected in a sediment sample collected from location S-1. AEHA concluded that location S-1 is a probable discharge point for ground water and that, based on topography, this location receives ground water and surface water discharge from the NSWC property. (Note that the "sump" was located on Navy property at the time of sampling in May 1994. As explained in Section 1.2.3, below, this "sump" is now located on Army property.)

Potential sources of contamination in the building 500 area include the NSWC Site 9 discussed above, two 890,000 gallon aboveground storage tanks that contain non-PCB transformer oil located on the east side of building 500, three underground storage tanks located on the south sides of buildings 504 and 505, an oil/water separator located on the south side of building 500, past spills of non-PCB transformer oil in building 500, or perhaps an unidentified hazardous waste disposal area located to the east or northeast of building 500 on either Army or Navy property.

1.2.3 Site W

ALC recently acquired property east of building 500 from NSWC that is referred to as Site W. As part of the property transfer process an initial investigation was performed by the Army Corps of Engineers, Baltimore District. Subsequently, a Preliminary Assessment (PA) of the area was performed (Plexus Engineering Group, 1995). Analysis of soil samples collected by the Army Corps of Engineers, Baltimore District indicated the presence of heavy oil and trace amounts of barium and chromium. Analysis of soil samples collected during the PA indicated the presence of TCLP metals (barium, chromium and lead) and PCBs below regulatory levels. DDE and DDT were detected at low levels from an upgradient sample location. Explosives and TPH were not detected in any samples. It should be noted that NSWC operates a hazardous waste storage facility (building 700) adjacent to Site W.

1.2.4 Blowdown Area (Area of Concern C)

A Resource Conservation and Recovery Act Facility Assessment (RFA) was performed for ALC (formerly Harry Diamond Laboratories) in 1989-1990 (A.T. Kearney, Inc., 1990). The U.S. Army Environmental Hygiene Agency (USAEHA) performed an evaluation of the solid waste management units at the facility (Groundwater Quality Survey No. 38-26-KF66-92) (USAEHA-1992).

During the visual site inspection phase of the RFA, an approximate three feet by five feet soil stain was observed on the northeast side of building 500. The stain apparently was caused by the discharge of pump oil from a vacuum system bleed-off. The RFA suggested soil samples be collected and analyzed to determine the nature and extent of contamination.

1.2.5 [redacted] Well

A private domestic water supply well owned by Mr. [redacted] of [redacted] is located approximately [redacted] of building 500. The well was sampled by NSWC personnel in May 1994 and analyzed for total petroleum hydrocarbons. The well was sampled concurrently in September 1994 by AEHA and NSWC(AEHA 1994). No contaminants were detected in any of the samples.

1.3 Site Specific Sampling and Analysis Problems

If any problems are encountered during the field activities of this remedial investigation that would cause a change in the scope of work, well and boring locations may be adjusted in the field at the discretion of the Design Manager and Project Hydrogeologist. Utilities are a main point of concern during the field sampling program and are not expected to be a problem, but if problems do arise, all questions should also be addressed to the Design Manager and Project Hydrogeologist.

2.0
Scope and Objectives

2.1 Statement of Work

Field work for this project is divided into 8 tasks. The task divisions are primarily for the purpose of managing the work. Descriptions of the tasks are outlined below.

2.1.1 Task 1 - Monitoring Well Drilling and Installation

Task 1 will include the drilling and installation of eight groundwater monitoring wells and two water observation wells, logging of soil and rock encountered during the drilling, measurement of groundwater levels, slug testing and permeability testing. Well locations are shown in Figure 1. The field procedures for this Task are detailed in Section 4.1 of the FSP. Task 1 field activities are summarized as follows:

2.1.1.1 Installation of Groundwater Monitoring Wells Outside Bldg. 500

Installation of five (5) two-inch diameter groundwater monitoring wells (C-5, C-6, C-7, C-8, C-12). All five wells will be located outside of Bldg. 500. All five wells will be installed in a manner so that approximately 15 feet of the 20 foot well screen will straddle the watertable. These wells may straddle the overburden/bedrock interface if the watertable is within 15 feet of the top of the bedrock surface.

2.1.1.2 Installation of Groundwater Monitoring Wells Inside Bldg. 500

Installation of two (2) two-inch diameter groundwater monitoring wells (C13 and C-14). Both wells will be installed inside Bldg. 500 and completed as flush mount wells. Both wells will have approximately a two foot riser casing and an eight foot screen section. It is anticipated that groundwater will be encountered directly below the concrete floor subgrade. Both wells will be installed in such a manner that the well screen straddles the watertable. These wells may straddle the overburden/bedrock interface.

2.1.1.3 Installation of Deep Bedrock Well

Installation of one (1) two-inch diameter deep bedrock groundwater monitoring well (C-11). This well will be located adjacent to existing well A-4. The bedrock well will be constructed so that the entire well screen is located in the bedrock.

2.1.1.4 Installation of Water Observation Wells

Installation of two (2) one-inch diameter water observation wells (C-9 and C-10). Both of these wells will be installed in a manner so that approximately 15 feet of the 20 foot well screen will straddle the watertable. These wells may straddle the overburden/bedrock interface if the watertable is within 15 feet of the top of the bedrock surface.

2.1.1.5 Field Permeability and Slug Testing

One one-inch diameter water observation wells will be selected for in-situ permeability testing (C-9). Testing will provide a vertical profile of permeability values. Slug tests will be performed on six wells to estimate values of hydraulic conductivity (C-5, C-6, C-7, C-8, C-12 and C-13).

2.1.1.6 Lithologic Sampling and Logging

Lithologic samples and rock core will collected and described in the field to define local geologic conditions.

2.1.1.7 Geotechnical Sampling

A total of eight soil samples will be sent to the geotechnical laboratory for physical parameters testing. The geotechnical samples will be collected from each of the five (5) two-inch diameter groundwater monitoring wells located outside of Bldg. 500 (C-5, C-6, C-7, C-8, C-12), the (2) one-inch diameter water observation wells (C-9 and C-10) and the one (1) deep bedrock groundwater monitoring well (C-11).

2.1.2 Task 2 - Soil Borings

Task 2 will include the drilling of four soil borings located adjacent to the oil water separator and underground storage tanks (USTs), collection of soil samples for chemical testing from the four borings and logging and screening of soil encountered during the drilling. Boring locations are shown in Figure 1. The field procedures for this Task are detailed in Section 4.2 of the FSP. Task 2 field activities are summarized as follows:

2.1.2.1 Location of Soil Borings

Four soil borings will be drilled in the vicinity of potential sources of soil and groundwater contamination in the Bldg. 500 area. Borings will be drilled in the vicinity of the oil water separator (TB-1), the 1,000 gallon UST near Bldg. 504 (TB-2), the 3,000 gallon UST near Bldg. 504 (TB-3) and the 550 gallon UST near Bldg 550 (TB-4).

2.1.2.2 Soil Sampling

Split spoon samples will be collected continuously from the ground surface until the water table is encountered.

2.1.2.3 Field Screening

Soil samples will be logged and screened using a PID with a 11.7 eV bulb to determine if volatile organic contamination is likely to be present.

2.1.2.4 Selection of Soil Samples for Laboratory Analysis

The one soil sample from each boring that exhibits the highest PID reading will be sent to the laboratory for chemical analysis. Otherwise, the soil sample closest to the water table will be sent to the laboratory for chemical analysis.

2.1.3 Task 3 - Groundwater Sampling

Groundwater samples for laboratory chemical analysis will be collected from the eight newly installed two-inch diameter groundwater monitoring wells (C-5, C-6, C-7, C-8, C-11, C-12 , C-13 and C-14), four existing monitoring wells installed by AEHA (A-1, A-2, A-3, A-4) and two domestic water wells owned by [redacted] and [redacted] No groundwater samples will be collected from the two newly installed one-inch water observation wells (C-9 and C-10). Groundwater samples will be analyzed for VOCs (EPA METHOD 8260), TAL Metals (filtered and unfiltered), SVOC (EPA 8270), Pesticides and PCBs (EPA 8081) and explosive compounds (EPA Method 8330).

2.1.4 Task 4 - Blowdown Area (Area of Concern C) Soil Sampling

The blowdown area is located directly beneath the vacuum system bleed-off on the east side of building 500. A soil sample will be collected to determine the nature and extent of contamination present. The soil sample will be collected with a hand auger from 0-24-inches below the ground surface. The sample will be analyzed for VOCs (EPA Method 8260) and SVOCs (EPA Method 8270).

2.1.5 Task 5 - Floor Drain Sampling

A water sample will be collected from the sump inside the building and the drainage system discharge point on the southeast side of building 500. Samples will be collected at high and low flow periods for a total of four samples. The samples will be analyzed for VOCs (EPA METHOD 8260), SVOCs (EPA METHOD 8270), TAL Metals (filtered and unfiltered), Pesticides and PCB (EPA 8081) and explosive compounds (EPA Method 8330).

2.1.6 Task 6 - Site W drainage Swale

Surface water and sediment samples shall be collected from two locations of the Site W drainage swale. Samples locations will be based on previous field work as described in Section 1.2.3. The samples will be analyzed for VOCs (EPA Method 8260), SVOCs (EPA Method 8270), TAL metals (unfiltered), Pesticides and PCB (EPA Method 8081), TPH (EPA 8015) and explosive compounds (EPA Method 8330).

2.1.7 Task 7 - [redacted] and [redacted] Wells

A record search will be conducted of the [redacted] and [redacted] wells to determine the wells' characteristics including well depth, water table depth, well capacity, and daily usage.

2.1.8 Task 8 - Investigation Derived Waste Management

Investigation Derived Waste (IDW) shall include drill cuttings, well development water, well purge water generated during sampling and personnel protective equipment used during the investigation. In keeping with the USEPA publication 9345.3-03FS, "Guide to the Management of Investigation-Derived Wastes", to minimize the generation and handling of waste material, IDW that does not appear contaminated (based on odor, visual observation and PID readings) will not be containerized. Soil cuttings that do not appear contaminated will be spread out on the ground surface adjacent to the borehole. Purge and development water that does not appear to be contaminated (e.g. no sheen) shall be discharged to the ground surface. However, this IDW water shall not be discharged within 50 feet of a well.

IDW that appears to be contaminated will be placed in 55-gal DOT-approved drums. The following information will be marked on the drums:

- Generator: ALC, Adelphi, MD
- Specific Origin: For example: Monitor Well/Soil Boring Number(s)
- Waste Description: For Example: Soil cuttings; purge water
- Generation Date

Containerized waste will be analyzed in accordance with local, state and federal regulations, as a minimum. In addition the waste will be analyzed in accordance with the requirements of the waste transporter and treatment, storage and disposal facility. Analytical results of groundwater samples will be used to determine the proper method of handling the containerized purge and development water. Composite samples of containerized soil cuttings will be analyzed in accordance with applicable regulations, as discussed above. To facilitate accurate characterization of waste, contaminated IDW will not be mixed; i.e.: contaminated IDW from one soil boring/monitoring well will not be mixed with IDW from another soil boring/monitoring well. Aqueous and solid IDW will not be mixed.

2.2 Objectives

The overall objective of this investigation is to determine the nature, extent and source(s) of contamination present in groundwater in the building 500 area. This information will be used to determine if any additional action is warranted at the site. Possible future actions include performing one or more of the following: risk assessment, feasibility study, remedial design and interim remedial action.

Task-specific objectives and rationale for proposed field work are provided below.

2.2.1 Task 1 - Monitoring Well Drilling and Installation

There is insufficient data to accurately characterize the hydrogeology and the nature, extent and sources of groundwater contamination in the building 500 area. Information obtained from drilling, installing and sampling the proposed wells will provide the information necessary to fill in the existing data gaps.

2.2.2 Task 2 - Soil Borings

Soil borings are proposed next to three existing underground storage tanks (USTs) and an oil/water separator (o/w/s). The soil borings will determine if the USTs or o/w/s are sources of contamination.

2.2.3 Task 3 - Groundwater Sampling

See Section 2.2.1.

2.2.4 Task 4 - Blowdown Area (Area of Concern C)

The RFA (A.T. Kearney, Inc. 1990) identified the blowdown area as an area of concern and suggested soil samples be collected to determine the nature and extent of contamination present. Analysis of the soil samples proposed in this investigation will provide the information necessary to determine if any further action is required. This is a very small site. It is anticipated that future action, if any, will consist of containerizing contaminated soil in one or two 55 gallon drums and disposing of the drums in accordance with the analytical results.

2.2.5 Task 5 - Floor Drain Sampling

Samples will be collected from the floor drain to provide data on the nature and extent of contamination present beneath the building slab. The data will assist in determining if past spills are a source of contamination as well as contribute to the understanding of the nature and extent of groundwater contamination at the site.

2.2.6 Task 6 - Drainage Swale Sampling

The objective is to determine if area W is a source of contamination. Existing data is inconclusive. The proposed sampling effort will provide data necessary to fill the existing data gap.

2.2.7 Task 7 - [redacted] and [redacted] Wells

Existing groundwater elevation data indicates the [redacted] and [redacted] wells may be downgradient of the building 500 area. Previous sampling of the [redacted] well indicated that contamination was not present. However, groundwater contamination was detected on ALC property (USAEHA, 1994). Additional sampling of the [redacted] and [redacted] wells is warranted to ensure the contaminants are not present.

In addition, a record search will be performed to determine well construction information. Well construction data will assist in evaluating the groundwater quality information obtained from the analysis of the well samples. For example, well construction information, if suitable, will be used to determine which aquifer(s) provide water to the wells.

2.2.8 Task 8 - Investigation Derived Waste Management

This task does not directly contribute to satisfying project objectives.

3.0
Project Organization and Responsibilities

3.1 Activities

BCOE has been authorized to perform the activities described within the Work Management Plan (WMP), Field Sampling Plan (FSP), Site-Specific Safety and Health Plan (SSHP), and the Quality Assurance Project Plan (QAPP). Field work described in this FSP will be covered under a standard QAPP (BCOE-HTRW).

All field work will be performed by the Baltimore District, U.S. Army Corps of Engineers. The geotechnical drilling and sampling for the project will be performed by the Baltimore District's Field Exploration Unit, Geology and Investigations Section (BCOE-FEU).

Analytical testing will be performed by Chemron, Inc., San Antonio, Texas.

Quality assurance testing will be provided by New England Division Environmental Laboratory, U.S. Army Corps of Engineers.

3.2 Personnel

The organizational structure and responsibilities are designed to ensure adequate project control and proper quality assurance for the field program at ALC.

ALC Primary POC: Robert P. Craig, P.E., Environmental Engineer, Risk Management Division.
(301) 394-4511

ALC Alternate POC: John Feustle, Environmental Engineer, Risk Management Division.
(301) 394-4511

Key Baltimore District personnel and their responsibilities are provided below:

Project Manager CENAB-EN-PP-E	Mr. Khal Masoud (410) 962-4448
Design Manager CENAB-EN-HM	Mr. William Thayer (410) 962-6121
Project Hydrogeologist CENAB-EN-GG	Mr. James Spratt (410) 962-6641
Project Geologist CENAB-EN-GG	Ms. Michelle Brock (410) 962-6649
Project Environmental Engineer CENAB-EN-HT	Mr. Gary Schilling (410) 962-3134
Quality Assurance Officer CENAB-EN-HI	Mr. Robert Miller (410) 962-6744
Health and Safety Officer CENAB-EN-HI	Mr. Maurice Wooden (410) 962-6740
Site Safety Officer (SSO) CENAB-EN-HT	Mr. Clint Kneten (410) 962-6743 (410) 962-7680 (mobile)
Field Geologists	Mr. Lyle Griffith/

CENAB-EN-GG	Mr. Andrejs Dimbirs (410) 962-4044 (410) 370-1348
Chief, Field Exploration Unit CENAB-EN-GGE	Mr. Bill Kriner (410) 962-4044
Sampling Personnel CENAB-EN-HT	Ken Hilton/Sarah Streeter/Clint Kneten (410) 962-4375/3631/6743

3.3 Responsibilities

Project Manager
- Primary liaison with ALC for project funding and schedule.
- CENAB POC for ALC Installation Restoration Program.
- Notifies ALC POC of changes that may affect the quantity or quality of generated data or costs.

Design Manager
- Liaison with ALC on technical issues.
- Tracks project costs and schedule.
- Ensures project objectives developed by ALC/CENAB are met.
- Coordinates CENAB team.
- Notifies Project Manager of field changes that may affect the quantity or quality of generated data or costs.

Project Hydrogeologist
- Responsible for coordinating all geotechnical branch activity during the project.
- Develops field investigation program that meets the project objectives.

Project Geologist
- Responsible for the preparation of the FSP, WMP, drilling instructions and RI report.
- Coordinates between geotechnical personnel in the office and field.
- Responsible for verifying that field work complies with WMP and FSP.
- Notifies Design Manager of field changes that may affect the quantity or quality of generated data or costs.

Environmental Engineer
- Responsible for coordinating of all Remedial Investigation and Design (RID) section activity.
- Provides guidance in all areas related to environmental and chemical engineering.

Quality Assurance Officer
- Develops and implements the Quality Assurance Project Plan.
- Coordinates with analytical chemistry laboratories (QA and QC) and reviews laboratory reports.

Health & Safety Officer
- Prepares and coordinates health and safety plan (SSHP).
- Supplies input for specific health and safety problems which may arise during operations.

- Provides oversight of SSO activities.
- Conducts specialized training as required.

Site Safety Officer
- Enforces the SSHP.
- Ensures required safety equipment is on-site, clean and operable.
- Revises equipment requirements or procedures based on new information.
- Coordinates emergency medical response.
- Designates rescue team for supplied air operations.
- Monitors personnel exposures/stress.
- Notifies appropriate emergency personnel in event of accident, fire or explosion.
- Has the authority to cease any operations not in compliance with the SSHP, or which threatens the health or safety of on-site personnel or the general public, or may cause significant adverse impact to the environment.
- Maintains field log containing weather conditions, instrumentation calibration documentation, records of air monitoring and personnel exposure data and other information as required.

Field Geologist
- Directs drilling procedures.
- Prepares drilling logs.
- Establishes and marks site boundaries.
- Coordinates access and security on site.
- Selects the type of drilling equipment and practices to be used.
- Directs drilling procedure.
- Responsible for collecting representative field data and recordkeeping of field activities, describing samples, packaging and shipping samples.
- Notifies Chief, Field Exploration Unit of field changes that may affect the quantity or quality of generated data or costs.

Chief, Field Exploration Unit
- Responsible for coordination of field drilling activities.
- Selects qualified personnel for field team.
- Notifies Project Geologist of field changes that may affect the quantity or quality of generated data or costs.

Sampling Personnel
- Responsible for collecting representative field data and record keeping of field activities.
- Comply with the FSP and SSHP.
- Report unsafe working conditions.

4.0
Field Activities

4.1. Task 1 - Monitoring Well Drilling and Installation

Eight (8) two-inch monitoring wells (C-5 through C-8 and C-11 through C-14) will be installed for the purpose of collecting water quality samples and delineating the extent of groundwater and surface water contamination around and within building 500. Seven of these wells (C-5 through C-8 and C-12 through C-14) are expected to straddle the overburden/ rock interface, while one well (C-11) will be a deep bedrock well. Two (2) one-inch piezometers (C-9 and C-10) will also be installed to gather static water level readings. Six of the monitoring wells are located outside of building 500, along with both piezometers. Two of the monitoring wells will be installed within building 500. These locations are shown in Figure 1.

4.1.1 Soil Sample Field-Screening

The soil samples taken from the monitoring well boreholes will be examined visually and with all observations recorded in a field logbook by the Site Safety Officer. Soil samples will be described and recorded in a field logbook by the Field Geologist according to the Unified Soils Classification System (USCS) for soils classification. A total of eight soil samples will be collected from each of the five (5) two-inch diameter groundwater monitoring wells located outside of building 500 (C-5 through C-8 and C-12), the two (2) one-inch diameter water observation wells (C-9 and C-10) and the one (1) deep bedrock groundwater monitoring well (C-11). Samples taken from these boreholes will be sent to the BCOE Geotechnical Lab. Each of these eight samples will be analyzed for grain size with a hydrometer and for total organic content. Additionally, a PID will be used to monitor all excavated soil and the work zone as specified in the SSHP.

4.1.2 Well Design and Installation

4.1.2.1 Monitoring Wells outside Building 500

Five two-inch diameter and two one-inch diameter piezometers will be installed in the site area outside building 500 to a depth of approximately 40 feet. Each well will be constructed of a Schedule 40 PVC with a 0.010-inch slot screen with a prepacked filter pack of Morie 00 or equivalent sand. The wells will have 20 foot screens with five feet above and fifteen feet below the water table regardless of the matrix the water table is located. Split spoon samples will be collected on 2.5 foot centers using ASTM Standard Penetration Test (SPT) procedures from ground surface to 10 feet below ground surface and on five foot centers thereafter until bedrock refusal (blow counts in excess of 100 blows/ 2 inches). If it is necessary to core, boreholes will be cored using an HQ size core bit. One soil sample will be chosen from each of the seven boreholes to be analyzed for grain size, using a hydrometer, and for total organic content.

One two-inch diameter bedrock well will be placed near existing well A-4 to an approximate depth of seventy feet. This well will be sampled to gain information about groundwater found within the bedrock. This well will be constructed of a Schedule 40 PVC with a 0.010-inch slot screen with a prepacked filter pack of Morie 00 or equivalent sand. The well will have a 10 foot screen placed at the last 10 feet of the total depth of the well. Split spoon samples will be collected in the same manner as the previously described seven monitoring wells. One soil sample from this borehole will be chosen for analysis of grain size and total organic content. Coring of the hole will be done with an HQ size core bit to total depth.

The following well installation procedure will be based on an estimated water level to be determined by measuring water depths in the pre-existing AEHA wells. These estimated depths will allow a target borehole depth for the new monitoring wells. From previous work water levels were measured between ten and twenty feet below grade. All well installations will be documented on well completion forms like those found in Appendix A. The procedure is as follows:

- Install well to estimated target depth by advancing 6.25-inch inner-diameter (ID) hollow stem augers while obtaining split spoon samples at five foot centers.

- If the target depth is not reached before bedrock refusal, the target depth will be obtained by coring the remainder of the hole.

- For boreholes where target depth is encountered within the overburden the hole will be left to obtain at least a twelve hour static water level reading. AUGERS WILL BE LEFT IN THE HOLE.

- For boreholes that are cored in order to reach the target depth, an HQ size corebit will be advanced to target depth, and if necessary this will be followed by a nominal 4.5-inch reamer to allow the prepacked well screen to fit into the borehole.

- The cored borehole will then be pumped and surged dry with a two-inch submersible pump and/ or hand pump (this will depend on the diameter of the well) to remove fines from any residual sloughing. The borehole will then be left for at least twelve hours to recharge before obtaining a static water level reading. IF THE HOLE IS NOT ABLE TO BE PROPERLY CLEANED OUT AFTER CORING WITH THIS PROCEDURE, ADJUSTMENTS WILL BE MADE IN THE FIELD TO RID THE HOLE OF RESIDUAL FINES.

- After a minimum of twelve hours, the boreholes, both cored and uncored are to be checked for static water levels.

- If after checking the water level there is not enough length between bottom of the hole and water level to allow for fifteen feet of well screen below the static water level, the hole will be advanced further to proper depth.

- Once proper borehole depth and static water level have been achieved, the two-inch diameter Schedule 40 PVC, twenty foot length, 0.010 slot prepacked screen and two-inch Schedule 40 PVC casing will be connected and inserted into the borehole. There will be a two foot stick-up of casing for all wells.

- With the screen and casing in place, more filter sand (Morie 00 or equivalent) will be added to fill any annular space not filled by prepacked screen. This filter sand will then be brought up to three feet above the top of screen, making sure there are no void areas between the well and bedrock and/or soil.

- A two-foot layer of bentonite will follow. This layer will consist of bentonite pellets hydrated in place for one hour using the designated water source.

- On top of the bentonite, a one-foot layer of fine sand (FJ90 or equivalent) will be placed to protect against grout seepage.

- The remainder of the well annulus will be grouted using a mixture of one 94 pound bag of portland cement to five pound of powdered bentonite to 6-8 gallons of water.

- After the installation of the monitoring wells, concrete pads will be placed around each of the wells.

4.1.2.2 Monitoring Wells inside Building 500

Two two-inch diameter monitoring wells will be installed inside building 500 to a depth of approximately 10 feet. Installation of the wells will begin after initial coring through an estimated 24-inch concrete slab. Procedure for borehole completion and well installation is as follows:

- Once the concrete slab has been cored through with a twelve-inch concrete bit to allow room to install flush mount well cover, a three-inch diameter split spoon will be advanced 18 inches through the subgrade. It is assumed that refusal will occur during this spoon drive.

- The well will then be cored to estimated target depth with an HQ corebit, and if necessary, this will be followed by a nominal 4.5-inch reamer to allow the prepacked well screen to fit into the borehole.

- The cored borehole will then be pumped and surged dry with a two-inch submersible pump and/ or hand pump to remove fines from any residual sloughing. The borehole will then be left for at least twelve hours to recharge before obtaining a static water level reading. IF THE HOLE DOES IS NOT ABLE TO BE PROPERLY CLEANED OUT AFTER CORING WITH THIS PROCEDURE ADJUSTMENTS WILL BE MADE IN THE FIELD TO RID THE HOLE OF RESIDUAL FINES.

- After a minimum of twelve hours the boreholes are to be checked for static water levels.

- If after checking the water level there is not enough length between bottom of the hole and water level to allow for eight feet of well screen, the hole will be advanced further.

- Once proper borehole depth and static water level have been achieved, the two-inch diameter Schedule 40 PVC, eight foot length, 0.010 slot prepacked screen and two-inch Schedule 40 PVC casing will be connected and inserted into the borehole.

- With the screen and casing in place , more filter sand (Morie 00 or equivalent) will be added to fill any annular space not filled by prepacked screen.

- A cement grout will be used to set the flush mount casing into place to protect the well.

4.1.3 Well Development

The purpose of well development is to allow groundwater to freely enter the well screen, enhance well yield, and allow for an accurate water level measurement. Additionally, development removes materials that may have been introduced into the formation during drilling operations.

4.1.3.1 Development Procedures

Newly installed two-inch monitoring wells will be developed no earlier than 48 hours after installation and in the manner prescribed below. Development will be achieved using an Aardvark Aqua-Developer tool fitted with appropriate diameter swab gaskets (i.e., nominal two-inch swab gaskets for a two-inch well) supported by plates on opposite ends of a 1.25-inch diameter slotted screen. Water will be pumped from the slotted screen between the swab gaskets using a dual rod air lifting technique. This method will provide continuous pumping while the swab is being moved up and down within the screened interval of the well. Development will proceed until at least five well volumes and five times the fluid lost in the well have been removed. The water shall be clear to the unaided eye. **Note that the two one-inch piezometers will be merely flushed out.**

In addition to the above criteria for well development, field measurements of temperature, pH, and specific conductivity are required to stabilize to within ten percent of the last measurement. Measurements of pH, conductivity and temperature along with observations, time, and date will be recorded as each well volume of water is removed. A sample of water will be collected for measurement of pH, conductivity, and temperature at the beginning of well development in order to establish a baseline for comparison with the water quality as well development proceeds. A well development record will be filled out and maintained. An example of such a development record is included as Appendix B.

4.1.3.2 Water Level Measurement

Water level measurements will be taken at each boring when encountered and at the completion of the boring. Water levels for all wells completed shall be taken each working day for the duration of the project. Water level measurements will be made using an electronic water level indicator and will be recorded to the nearest 0.1 foot.

4.1.4 Hydraulic Conductivity

The hydraulic conductivity portion of this FSP consists of slug tests and in situ borehole tests. These tests will help determine hydraulic conductivity and permeability of the soil in the borehole above and below the water table.

4.1.4.1 Slug tests

Slug tests will be performed on six wells. The purpose of these tests will be to acquire data used to calculate hydraulic conductivity values under in situ conditions for the wells. These tests are beneficial in alleviating errors that are incurred in laboratory tests of disturbed samples. The slug tests will consist of:

1) work in the office before tests are run in the field
2) the field tests
2) data analysis of the obtained information.

The procedure to be used for performing these tests is found in Appendix D, while forms to fill out slug test data are in Appendix E.

4.1.4.2 In situ Borehole Tests

There will be three constant head packer tests done on a borehole during this project, one on each selected interval of the borehole to test a different type of stratum for permeability. Procedures for these tests can be found in Appendix F.

4.2 Task 2 - Soil Borings

Four soil borings are located in the building 500 area. One (TB-1) adjacent to the oil/ water separator (OWS) and three (TB-2 through TB-4) at previous underground storage tanks (USTs) locations near buildings 504 and 550. These borings will be advanced to the water table. The water table is estimated to be 15-20 feet below grade. Split spoon samples will be collected continuously or the total depth of the borehole. Proposed boring locations are shown in Figure 1.

4.2.1 Sampling Intervals and Depths

- The four soil borings will be drilled to approximately 20 feet. The borehole will be advanced until spoon refusal. Refusal will be 100 blows/ 2 inches according .

- Split spoon samples will be collected at continuous 2 foot intervals from ground surface until spoon refusal. The split spoon used will have a minimum two inch inner diameter (ID) with a minimum two foot recovery of sample.

It is anticipated that bedrock will be 20 feet below grade. Soil samples will be collected, labeled, placed in glass jars, and stored as directed in the Work Management Plan (WMP).

4.2.2 Field Screening/ Sampling Procedures

Split spoon soil samples collected from UST borings will be field-screened with a Photo-ionization Detector (PID) with an 11.7eV bulb to determine if any volatile organic compounds (VOCs) are present. The soil samples will be examined visually and the observations recorded in a field logbook. Soil samples will be described according to the Unified Soils Classification System (USCS) for soils classification. Additionally, the PID will be used to monitor all excavated soil and the work zone as specified in the SSHP. Samples where the PID indicates VOCS are present will be sent to the laboratory and analyzed for VOCs, SVOCs, and/ or BTEX using EPA Method 8260 or other appropriate methods. In the event that VOCs are detected in more than one soil sample from a particular borehole, the soil sample with the highest PID reading shall be sent to the lab for analysis. If no VOCs are detected in any soil samples from a particular borehole, the soil sample closest to the water table will be sent to the lab. One sample per boring (maximum of four total samples) shall be sent to the laboratory for analysis.

4.3 Task 3 - Groundwater Sampling

The subsurface water sampling portion of the FSP will involve the [redacted] Well, [redacted] Well, four existing monitoring wells and all newly installed monitoring wells located on the map in Figure 1. The objective of sampling all of these wells is to gain an understanding of the water quality of the underlying aquifer and to determine the distribution of contaminants present. All wells will be sampled for the same parameters: VOCs (EPA Method 8260), SVOCs (EPA Method 8270), TAL Metals (filtered and unfiltered), Pesticides and PCBs (EPA 8081) and explosive compounds (EPA Method 8330). Water observation wells will not be sampled. The following provides a step-by-step procedure for collecting groundwater samples in the field. Observations made during sample collection will be recorded in a field notebook and on a field data sheet.

4.3.1 Equipment Decontamination

Before any purging or sampling begins, all well probes, bailers, and other purging or sampling equipment will be decontaminated as described in 4.10. If possible, use pre-cleaned sampling equipment to minimize IDW.

4.3.2 Instrument Calibration

Before going into the field, the sampler shall verify that field instruments are operating properly. The pH meter requires same day calibration prior to use. Calibration times and readings will be recorded in a notebook to be kept by the field sampler.

4.3.3 Monitoring Well Purging

Monitoring wells must be purged prior to sampling to remove stagnant and or thermally stratified water from the well casing so that a sample of water representative of the aquifer (or portion of the aquifer) can be obtained. Purging must be performed in a manner that minimizes disturbance of the aquifer and aeration of the column of water within the well to minimize the loss of volatile components. Wells may be purged using either a bailer or a submersible pump as outlined in Section 4.3.4 below. Samples of the purge water shall be tested for pH, specific conductance, dissolved oxygen, temperature and turbidity to determine when stagnant casing water has been removed and that the well has equilibrated with the natural groundwater. This information will be recorded in the field book and on the Well Development Form (Appendix B). Purging shall continue until stabilization parameters are within 10% over two successive readings, or until three well volumes have been removed. The well volume shall be calculated as the volume of water within the casing plus the volume of water within the filter pack, considering a porosity of 30% for the filter material (see bullet items in 4.3.4 below). Note that turbidity is measured to document the condition of the purge/sample water and is not considered an indication of stabilized groundwater. All wells shall be purged on the same day that samples are taken. Evacuated well water will be handled as defined in Section 7.0 for IDW.

4.3.4 Documentation of Conditions Prior to Purging

Prior to purging and sampling, static water level readings shall be obtained in all monitoring wells. Water level measurements shall be made using a decontaminated water level meter. The open depth of the well shall also be measured and shall be compared to the as-drilled depth to evaluate/document silt accumulation in the well. Where the depth of the silt accumulation is greater than 2 inches and purge water is excessively turbid, additional development to remove the silt accumulation may be needed. Before well purging begins, the following procedures shall be performed at each well:

- The condition of the outer well casing and any unusual conditions of the area around the well shall be noted in the field logbook.
- Clean plastic sheeting shall be placed around the well.
- The condition of the inner well cap and casing shall be noted.
- The static water level shall be measured (to nearest 0.01 foot) and recorded from a permanent easily identified measuring point on the well casing (e.g. notch on north side, top of PVC well casing). The time of measurement shall be indicated.
- The total well depth shall be measured and recorded from the same permanently identified point on the well casing.

- The open depth of the well shall be compared to the as-drilled depth to verify if the well screen area is clear of silt and obstructions.

- The volume of water in the well casing shall be calculated in gallons based on feet of water and casing diameter using the following equations:

  vol. of casing water(gal)=
  $12 \text{ in/ft} \times \text{water col. (ft)} \times \Pi \text{ (well radius)}^2 \times 0.0043 \text{ gal/in}^3$

  vol. of annulus water(gal)=
  $12\text{in/ft} \times \text{water col.(ft)} \times \Pi \times [\text{(bore.radius)}^2 - \text{(well radius)}^2] \times 0.043 \text{ gal/in}^3 \times 0.3$

  where 0.3=assumed porosity of filter pack

- From the above calculation, the three casing volumes to be removed shall be calculated. Multiply the volume of one well casing volume by three (3) to obtain the minimum volume of water to be evacuated.

- An initial sample shall be obtained from the bailer or purge pump for field measurements of temperature, conductivity, dissolved oxygen, turbidity, and pH, and for observation of water quality. This sample will be discarded after these initial measurements are recorded.

4.3.5 Method of Purging

Where submersible pumps are used to purge monitoring wells, the pump shall be operated at a discharge rate such that the entrance velocity of groundwater through the well screen is maintained at less than 0.1 ft/sec. Entrance velocities of greater than o.1 ft/sec may cause turbulent flow through the well screen in which case volatile organic compounds may be lost. A table of entrance velocities vs. yield is included as Table 3 for reference. The table was developed considering a monitoring well with a two inch diameter PVC well screen with a slot size of 0.010 inches (10 slot). Similarly, where a bailer is used for purging, the bailer should be hand lowered slowly into and through the water column to minimize agitation of the water within the well, so as to avoid aeration and loss of volatile components. Where the permeability and rate of water level recovery in the well is low, the rate of purging should be adjusted to avoid purging the well to dryness. Where the rate of inflow to the well is so slow that purging to dryness cannot be avoided, the well should be sampled as soon as possible after water level recovery. When evacuating a well using a pump, the pump intake should be placed:

- near the bottom of the screened interval for low recovery wells (wells that can be pumped dry).
- near the top of the water column for high recovery wells (little drawdown with pumping).

If the well is bailed or pumped dry during evacuation, it will be assumed that all stagnant water has been removed and the well is ready to be sampled. Every attempt should be made to avoid pumping a well to dryness. If recovery is very slow, samples shall be obtained as soon as sufficient water is available in the well.

4.4 Task 4 - Sampling of Blowdown Area

A soil sample shall be collected from the blowdown area (Area of Concern C as designated in the RFA) to determine if contamination is present. The area is located on the east side of building 500 beneath the vacuum system bleed-off pipe. The soil sample will be collected with a hand auger from 0-24-inches *below the ground surface. The sample will be analyzed for VOCs* (EPA Method 8260) and SVOCs (EPA Method 8270).

4.4.1 Sampling procedure

1) Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.

2) Attach the auger bit to a drill rod extension and further attach the "T" handle to the drill rod.

3) Clear the area to be sampled of any surface debris (twigs, rocks, litter).

4) Begin drilling and periodically remove accumulated sediment. This prevents accidentally brushing loose material into the borehole when removing the auger or adding drill rods.

5) After reaching the desired depth, slowly and carefully remove the auger from boring.

6) Remove auger tip from drill rods and replace with a precleaned or decontaminated thin-wall tube sampler. Install proper cutting tip.

7) Carefully lower corer down borehole. Gradually force corer into sediment. Take care to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring because the vibrations may cause the boring wall to collapse.

8) Remove corer and unscrew drill rods.

9) Remove cutting tip and remove core from device.

10) Discard top of core (approximately 2.5 cm), which represents any material collected by the corer before penetration of the layer in question.

11) Begin sampling with the acquisition of the grab VOC samples, conducting the sampling with as little disturbance as is possible to the media.

12) To homogenize the remainder of the sample location for the SVOC sample, transfer the soil into the stainless steel bowl for mixing.

13) Repeat steps as necessary to obtain sufficient sample volume.

14) Transfer sample into an appropriate sample bottle with a stainless steel spoon or equivalent.

15) Secure the cap tightly.

16) Label the sample bottle with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters. Refer to section 5.5.2 for the proper labeling procedure.

17) Place filled sample containers on ice immediately.

18) Complete all chain-of-custody documents and field sheets, and record information in the field logbook. Refer to Section 5.5.3.

19) Properly clean and decontaminate the equipment prior to reuse or storage IAW Section 4.10.3.

4.5 Task 5 - Surface Water Sampling of Bldg 500 Floor Drains/Site W Drainage Swale

4.5.1 Dippers and pond samplers.

(a) Dippers and pond samplers prevent unnecessary contamination of the outer surface of the sample bottle that would otherwise result from direct immersion in the source. Dippers and pond samplers can either be reused or discarded. Discarding the samplers would eliminate the need for decontamination. With the pond sampler, samples can be obtained at distances as far as 10 ft from the edge of the source, preventing the technician from having to physically contact the source. Dippers and pond samplers perform similar functions, except that the length of the dipper is smaller.

(b) The pond sampler consists of an adjustable clamp attached to the end of a two- or three-piece telescoping aluminum or fiberglass pole that serves as the handle. The clamp is used to secure a sampling beaker.

(c) Sampling procedure:

1) Spread new plastic sheeting on the ground at each sampling location to keep sampling equipment decontaminated and to prevent cross-contamination.

2) Assemble the dipper or pond sampler. Make sure that the sample container and the bolts and nuts that secure the clamp to the pole are tightened properly.

3) Collect samples by slowly submerging the precleaned dipper or pond sampler with minimal surface disturbance. Make sure that the open end is pointed upstream.

4) Retrieve the dipper or pond sampler from the surface water with minimal disturbance.

5) Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/sampler's edge.

6) Empty the sampler slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence.

7) Continue delivery of the sample until the bottle is filled.

8) Preserve the sample as specified in the QAPP.

9) Check that a PTFE liner is present in the cap. Secure the cap tightly.

10) Label the sample bottle with an appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters IAW 5.5.2.

11) Place filled sample containers on ice immediately, along with the required trip blank.

12) Record the information in the field logbook and complete the chain-of-custody documents and field sheets IAW Section 5.5.3.

13) Properly clean and decontaminate the equipment prior to reuse or storage IAW Section 4.10.3.

4.6 Task 6 - Surface Soil/Sediment Sampling of Site W Drainage Swale

For the Site W drainage swale samples can be taken either by the scoop or trowel method or with a tube sampler.

4.6.1 Scoop or Trowel Method

(a) The scoop or trowel method is a very accurate procedure for collecting representative samples. This method can be used in many sampling situations but is limited to sampling exposed sediments or sediments in surface waters less than 6 in. deep. The scoop or trowel sampler will not be used for sampling in waters more than 6 in. deep.

(b) The simplest, most direct method of collecting sediment samples is with the use of a stainless steel scoop or trowel. A stainless steel scoop or trowel will be used to collect the sample and a stainless steel bowl will be used to homogenize the sample when applicable to the subsequent analysis. The scoop or trowel should not be chrome-plated since metals are contaminants of concern.

(c) Sampling procedure:

1) Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.

2) Sketch the sample area and note recognizable features for future reference.

3) Insert scoop or trowel into material and remove sample. In the case of sludges exposed to air, it may be desirable to remove the first 1-2 cm of material prior to collecting the sample.

4) Begin sampling with the acquisition of grab VOC samples, conducting the sampling with as little disturbance as is possible to the media. Samples to be analyzed for VOCs will not be homogenized.

5) For homogenization of the remainder of the sample, transfer the sample to the stainless steel bowl for mixing.

6) Transfer sample into an appropriate sample bottle with a stainless steel spoon or equivalent.

7) Check that a PTFE liner is present in cap. Secure the cap tightly.

8) Label the sample bottle with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters. Refer to Section 5.5.2.

9) Place filled sample containers on ice immediately.

10) Complete all chain-of-custody documents and field sheets and record in the field logbook. Refer to Section 5.5.3.

11) Decontaminate sampling equipment after use and between sample locations IAW Section 4.10.3.

4.6.2 Tube Sampler Method

(a) Equipment for the tube sampler is portable and easy to use. Discrete sediment samples can be collected efficiently. Disadvantages of the tube sampler include its limited sampling depth and inability to collect sediment samples in water bodies greater than a few feet in depth. The tube sampler may not penetrate gravelly or rocky sediments.

(b) Tube samplers are a simple and direct method for obtaining sediment samples. The corer is forced into the sediment. The corer is then withdrawn and the sample is collected. In non-cohesive soils, sample retention may be a problem. In this case a piston-type sampler is recommended.

(c) Sampling procedure:

1) Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.

2) Clear the area to be sampled of any surface debris (twigs, rocks, litter).

3) Gradually force corer into sediment.

4) Remove corer.

5) Remove sediment core from corer and place core on a clean working surface.

6) Discard top of core if any organic material is present.

7) Begin sampling with the acquisition of grab VOC samples, conducting the sampling with as little disturbance as is possible to the media.

8) For homogenization of the remainder of the sample, the sample is transferred to the stainless steel bowl for mixing.

9) Repeat steps (3) through (8) as necessary to obtain sufficient sample volume.

10) Transfer sample into an appropriate sample bottle with a stainless steel spoon or equivalent.

11) Secure the cap tightly.

12) Label the sample bottle with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters IAW Section 5.5.2.

13) Place filled sample containers on ice immediately.

14) Complete all chain-of-custody documents and record in the field logbook IAW 5.5.3.

15) Decontaminate sampling equipment after use and between sample locations IAW Section 4.10.3.

4.7 Task 7 - Sampling of [redacted] Well and [redacted] Well

The specifics to sampling these domestic wells will be determined in the field, but the following outline can be used before mobilizing into the field:

a) Prior to sampling an individual water supply system it is essential to evacuate all standing water from the well, storage tank, and plumbing. A good rule-of-thumb is to flush for 15 minutes prior to sampling. Listen for the pump to turn on. This is a good indicator that the tank and plumbing are being evacuated. Opening additional faucets, flushing toilets, etc., will use more water and shorten waiting time.

b) Because a raw water sample is desired, sample as close to the well head as possible and prior to the storage tank or any treatment system. Sometimes basement or outside faucets may be the best sampling point for this type of sample.

c) If the kitchen faucet is used, the aerator should be removed.

4.8 Test Boring Layout and Utility Clearance

All borings and well locations will be cleared by the base utility clearance personnel prior to conducting any subsurface field activities. After the field sampling program is completed, a subcontractor (to be decided on later) will be brought in to survey all soil boring and well locations. The ground surface, outer casing, and inner casing (for the wells) elevations shall be surveyed to within 0.01 ft. Horizontal coordinates shall be surveyed to within 0.01 ft.

4.9 Sample Containers and Preservation Techniques

4.9.1 Sample Containers

The quantity and types of sample containers required for the various sample matrices and respective analytical parameters are listed in Table 1. All containers must be precleaned, have Teflon-lined seals and will be supplied by the laboratory. When both organic and inorganic substances are to be analyzed separate samples will be taken.

4.9.2 Sample Preservation

After collection of each sample, the sample will be preserved with the appropriate preservative(s) for the sample matrix and parameter to be analyzed. Table 2 contains a listing of containers and preservatives to use, and maximum holding times for each type of sample collected for this project.

4.10 Decontamination Procedures

4.10.1 Drilling and Heavy Equipment Decontamination

Drilling rigs will be decontaminated at the decontamination station. The following steps may be used to decontaminate drilling and heavy equipment:

- Personnel will dress in suitable safety equipment to reduce personal exposure as required by the SSHP.
- Remove as much soil and debris as possible from augers and tools at the borehole or sampling location.
- Equipment that will not be damaged by water, such as drill rigs, augers, drill bits, and shovels, will be sprayed with a hot water, high-pressure washer, then rinsed with potable water. Care will be taken to adequately clean the insides of the hollow-stem augers.
- If augers and tools are visibly contaminated, clean tools in large tub so that decontamination water is contained.
- After cleaning, place augers and tools on plastic sheeting in the designated steam cleaned decontamination area.
- Any decontamination water that was contained due to visible contamination on tools shall be placed in 55-gallon drums and the source of the water (i.e. borehole where tools were last used) shall be marked on the drum.

4.10.2 Well Materials Decontamination

All well materials will arrive to the site still in its shipping containers. If any of the well material is in an open package or becomes dirty before insertion into the well or piezometer, it is to be decontaminated using the steam cleaner. There should not be anything introduced to the well except for the well construction materials mentioned in 4.1.2.1.

4.10.3 Decontamination of Bailers

Bailers shall be decontaminated prior to use in the monitoring wells as follows:

1) Non-phosphate detergent wash
2) Tap water rinse
3) 10% Nitric acid rinse (trace metal or higher grade HNO_3 diluted with distilled/deionized water)
4) Distilled/deionized water rinse
5) Isopropanol or methanol rinse
6) Distilled/deionized water rinse
7) Wrap in aluminum foil if not used immediately

Bailers should then be wrapped in foil and delivered to the site and should not be unwrapped until ready for use. A new length of polyethylene rope shall be used for sampling at each well.

4.10.4 Pump Decontamination Procedures

Portable pumps used for purging and sampling shall be decontaminated prior to and following use. The cleaning process shall include an external non-phosphate detergent wash with a tap water rinse of the pump casing, hoses and cables, followed by a 20 gallon flush of potable water through the pump. If available, the external tap water rinse may be supplemented with a high pressure hot water rinse. A new length of discharge tubing shall be used for each well sampled.

4.10.5 Decontamination of Measurement Equipment

Measurement equipment such as water level transducers and electric water level meters shall be decontaminated using a non-phosphate detergent wash with a tap water rinse of the external portion of probes, cables and/or signal wires.

5.0
Sample Chain of Custody/Documentation

5.1 Field Logbook

The field team leader will be required to keep a field logbook to document all field activities. The logbook will be a bound notebook with water resistant pages. The following guidelines will be followed when entering information into the logbook:

a) All entries will be made in waterproof ink.

b) All time will be reported as military time.

c) All pages will be numbered consecutively.

d) No blank pages or sections of pages will be allowed. If a page is not completely filled in, a line will be drawn through the blank portion and initialed by the person keeping the logbook.

e) Errors will be corrected by drawing a single line through the error and initialing the change.

f) Each page will be signed and dated by the person responsible for keeping the logbook.

The notebook shall contain the following information:

1) The project, location, borehole identification, date, field personnel, visitors to the site, and a description of the sampling method will be recorded at the beginning of each borehole documentation.

2) Date, weather conditions, and equipment calibration information will be recorded at the beginning of each day.

3) Documentation of sample collection to include sample identification number, sample matrix, sample location, time of collection, sampling depths, results of sample screening, sample description, and testing parameters.

4) Manufacturer's name and lot numbers of any chemicals used.

5) As-built sketches of monitoring wells.

6) PPE level and changes in level of protection shall be noted.

7) Any deviation from the sampling plan shall be noted and explained.

5.2 Photographic Record

The field geologist and field sampling personnel shall complete photographic records of their respective field activity. All photographs will be submitted to the Project Geologist upon completion of the work. Photographs will be annotated on the back with the date, hole number, sample number (if applicable) and viewing direction.
If the photograph is of a sample or a well, a dry erase board will be held up next to the item being photographed. This board will show the date, project name, and all other relevant information (e.g. well ID, sample number).

The field geologist will take one photograph per finished monitoring well and piezometer. Also, several photographs of the general area where the soil borings and monitoring wells have been drilled and/or installed should be taken to give a general reference overview of the site. During well development, at least one photograph of the final development sample will be taken. If sufficient time is available while drilling, photographs may be taken of drilling activity.

Personnel performing environmental sampling will take photographs during all phases of sampling (i.e. surface water, surface and subsurface soil). Photographs will also be taken during sampling as a reference of the sampling procedure.

5.3 Boring Logs

A complete field log for each boring (stratigraphic borings as well as borings for monitoring wells) will be prepared. Standard ENG Form 1836 and ENG Form 1836a will be used and each heading block will be completely filled out. In addition, each log will include the type of drilling rig, size and type of bit used, diameter of boring, equipment calibration information, depth and identification number of each sample, time the sample was collected, sample testing parameters, water level information, field screening results, and a description of the materials encountered.

5.4 Well Installation Diagrams and Development Records

All monitoring wells will have completed installation diagrams and development records. An example of each of these forms is located in Appendix A and Appendix B respectively.

5.5 Sample Documentation

5.5.1 Sample Designation/Identification

All samples, including QC duplicates, collected during the field investigation will be identified and labeled with a site specific sample identification code. The site specific sample code will be based on the following system:

AL - *Site designation: Army Lab*

MP10 - Number refers to boring number (MP-10)

S/W - Letter refers to sample type (Soil or Water)

xx - Numbers refer to sample number (01 to 23)

Note: For each of the two QC split samples collected, label the sample using the identification code system as outlined above. However, make a notation in the field logbook as to which samples were collected as QC splits.
This site specific sample ID code shall be recorded in indelible ink on the sample label and the chain of custody form accompanying each sample submitted to the laboratory for analysis.

5.5.2 Sample Labels

Field personnel are responsible for uniquely identifying and labeling all samples collected during a field investigation. All labeling will be completed in indelible ink and be securely affixed to the sample container. All sample bottles shall be labeled containing the following information:

a. CENED project number (E0567) and site name
b. Unique sample identification number
c. Sample description
d. Parameters to be analyzed for
e. Sampling date and time

f. Initials of sampling technician
g. Method of sample preservation/conditioning used

5.5.3 Chain of Custody Form

Documentation will be accomplished through a chain of custody form that records each sample and the individuals responsible for sample collection, transfer, shipment, and receipt by the laboratory. This form must also contain pertinent information about sampling location, date, and times, signature of sampling technician, types and numbers of samples collected and shipped for analysis in each lot, parameters to be analyzed per sample (including project unique specific sample preparation or extraction methods/detection limits), unique sample identification numbers assigned to the sample(s), and the project name and number (E0567).

Samples shall be accompanied by an approved and completed chain of custody form during each step of custody, transfer, and shipment. When physical possession of samples is transferred, both the individual relinquishing the samples and the individual receiving them shall sign, date, and record the time on the chain of custody form. The sample custodian will receive the samples at the contract laboratory. The sample custodian will receive the samples at the New England-QA laboratory.

For samples shipped via overnight carrier to the laboratory, the person relinquishing custody of the samples to the overnight carrier shall sign the custody form, noting that custody is relinquished to the carrier, and noting the air bill number of the shipment and date, time on the form. The person receiving the samples from the carrier shall sign for custody of the samples, indicating that samples were received from the carrier and also noting the air bill number and date, time of receipt.

It is important to note that only <u>one</u> site is listed per form even if the sites have the same project number. An example chain of custody record form is contained in Appendix C.

6.0
Sample Packing and Shipping

Samples will be placed in individual containers compatible with the intended analysis, properly preserved, and sealed with a Teflon-lined screw cap prior to shipment to the laboratory. Sample labels, field notebook information, and chain of custody forms are checked to be sure there are no errors in sample identification and to verify that all the required information has been supplied. The samples are then packaged to prevent breakage and/or leakage.

As soon as field personnel are ready to transport samples from the field to the contract laboratory, the laboratory point of contact (POC) shall be notified by telephone of the shipment along with the estimated time of arrival.

No chemical analytical samples shall be held on site for more than 48 hours. All samples will be shipped to the designated laboratory in sealed coolers via overnight carrier or delivered in person.

In order to maintain chain of custody protocol as well as to prevent breakage of the sample containers, the packaging procedures shall be as follows:

a. Secure the lids of properly labeled samples with strapping tape.

b. Place approximately a 3-inch layer of inert cushioning material (e.g. vermiculite) in the bottom of a waterproof metal or equivalent strength plastic ice chest or cooler.

c. Enclose the bottles in clear plastic bags, through which labels are visible, and seal the bag. Place the bottles upright in the cooler so they do not touch and will not touch during shipment.

d. Put in additional packing material to partially cover sample bottles (more than halfway), to ensure that they do not shift during transport.

e. Place sealed plastic bags of ice <u>(double bagged)</u> in ziplocs around and on top of the samples bottles. If chemical ice is used (i.e. blue ice), it should be placed in a plastic bag. NOTE: Use sufficient quantity of ice in order to maintain samples cool during shipment at a temperature of $4^{o}C$.

f. Seal the appropriate chain of custody form(s) in a ziploc plastic bag, and tape it securely to the inside lid of the cooler.

g. Tape the drain shut.

h. Close and lock/latch the cooler. Secure the lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.

i. Attach completed shipping label to top of the cooler.

j. Put "This Side Up" labels on top of the cooler and "Fragile" labels on at least two sides.

k. Affix numbered and signed custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

While packing each cooler for shipment, remember not to exceed the weight limit set by the shipper.

7.0
Task 8 - Investigation-Derived Wastes (IDW)

All drill cuttings, development and well purge water generated during the field investigation will be disposed of according to USEPA publication 9345.3-03FS, "Guide to Management of Investigation-Derived Wastes" as agreed upon during the 19 March ALC Team meeting with the Maryland Department of the Environment (MDE). This will be followed in order to minimized the generation and handling of IDW.

IDW that does not appear contaminated (based on odor, visual observation and PID readings) will not be containerized. Soil cuttings that do not appear contaminated will be spread out on the ground surface adjacent to the borehole. Purge and development water that does not appear to be contaminated (e.g. no sheen) shall be discharged to the ground surface provided that it is not discharged within 50 feet of a well.

CENAB shall containerize and analyze all IDW that appears to be contaminated. All decon water will be containerized into 55-gallon drums and will be properly labeled. Drum labels indicating project name, location, date, and contents (e.g. decon water) will be placed on drums using waterproof ink and see-through adhesive labels, OR using a permanent paint pen in an easy-to-read color. Used PPE will be double bagged and disposed of as general refuse.

ALC will be responsible for disposing of all containerized waste.

8.0
Quality Control Summary Report (QCSR)

For this confirmation study, upon completion of field activities at the site, a separate QCSR will be completed, dated and signed by the site manager to be included in the final report. A copy of this QCSR will be sent to the HTRW Branch project chemist for review. These reports shall include at least the following information:

a. Samples collected, including the dates collected.

b. Weather conditions encountered at time of sampling.

c. Any deviations from the QAPP, problems identified, corrective actions taken, observations made.

These reports may be generated from information recorded in the field logbook by the field team leader. Evidence of the sample traceability from collection, to shipment, to laboratory receipt, and laboratory custody until proper disposal must be documented.

9.0
Corrective Actions

A description shall be included in the logbook by the Site Safety Officer of any problem and the corrective actions taken, verbal/written instructions from USACE personnel, and any other pertinent information. Technical problems and corrective actions should be relayed to the Project Hydrogeologist and Field Supervisor either verbally or in writing.

10.0
Project Schedule

A proposed schedule for completing the tasks described within the FSP by the Baltimore District is presented in Figure 2. Any work completed in addition to that presented herein would be addressed at a future date if those tasks are required. This schedule assumes a field investigation start date of 13 May 1996.

11.0
Sampling Apparatus and Field Instrumentation

11.1 Environmental Sampling Personnel's Equipment and Supplies

The following is a list of anticipated field equipment and supplies that will be necessary to complete the proposed field sampling. All instruments and equipment used during drilling and sampling activities will be operated daily, calibrated daily, and maintained according to manufacturers guidelines and recommendations. This list is for suggested guidance but is not intended to be comprehensive:

Sampling Equipment and Supplies

- Stainless Steel Spatulas & Spoons
- Stainless Steel Bowls
- Split Spoon Samplers
- Drilling Equipment
- Well/concrete pad materials
- Field Notebook
- Chain of Custody Forms
- Inspector's Daily Report forms
- Boring Log Forms (Eng Form 1836), well completion/development forms
- Marking Pens (waterproof)
- Camera and Film
- One-gallon Ziploc Bags
- Bubble Wrap/Packing Material (Vermiculite)
- Coolers with Ice/Pack
- Engineer's ruler, measuring tape
- Custody Tape, strapping tape
- Geotech sample jars
- Sample containers (Lab provided)
- Sample container labels
- PPE as specified in SSHP
- PID w/ calibration gas
- Combustible gas indicator
- pH/Conductivity/Temp meter
- pH calibration solutions
- Water level indicator
- LNAPL Indicator

Decontamination Equipment and Supplies:

- Phosphate free detergent
- Methanol (HPLC grade)
- Nitric Acid (1% soln)
- Scrub Brushes
- Steam Cleaning Trailer
- Nalgene Squirt Bottles
- Trash Bags
- Potable Water Dist./Deionized Water
- Plastic Wash Tub (5)
- Paper Towels
- Polyethylene Sheeting
- Five gallon buckets

11.2 Field Geologist's Equipment and Supplies

It is the responsibility of the field geologist to log all well development activity and water sample information through visual descriptions and well development equipment. Anticipated well development equipment is a pH/Conductivity/Temperature meter. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Calibration documentation shall be maintained in the field geologist's logbook as well as being included on boring logs.

- pH/ Conductivity/ Temp meter
- Waterproof marker and pens
- Water level indicator (m-scope)
- Logbook
- pH calibration solutions
- Measuring tape
- Engineer's ruler
- Geotech sample jars
- Jar labels
- Plastic garbage bags
- Drilling equipment
- Well/ concrete pad materials
- Steam cleaner
- Well completion forms (photocopy from Appendices)
- Well development forms (photocopy from Appendices)
- Inspector's daily report forms
- USCS chart

TABLE 1

SUMMARY OF LABORATORY TESTING

Media/ Location	VOAs SW-846 8260	SVOCs SW-846 8270	Pest/PCBs SW-846 8081	Explosives SW-846 8330	TAL Metals Dissolved SW-846	TAL Metals Total SW-846
Monitoring Wells	8	8	8	8	8	8
GW Splits/Dup. QC (Chemron)	1	1	1	1	1	1
Existing Monitoring Wells	4	4	4	4	4	4
Floor Drains	2	2	2	2	2	2
DRAIN Splits QC (Chemron)	1	1	1	1	1	1
Residential Wells	2	2	2	2	2	2
QA (NED Lab)	1	1	1	1	1	1
Trip Blanks QC (Chemrom)	3					
QA (NED Lab)	1					
Total NED Samples	VOA trip 2	1	1	1	1	1
Total Chemron Samples	22	18	18	18	18	18

Table 2

CONTAINERS, PRESERVATION, and HOLDING TIMES

Analysis	Containers	Preservation	Holding Times
Volatiles Water	3 40-ml amber glass VOA vials Teflon-lined cap	Cool, 4° C HCl to pH < 2	14 days
Soil/Sediment	2 40-ml glass VOA vials, Teflon lined cap	cool, 4° C	14 days
Semivolatiles Water	2 1 L amber glass bottles	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Soil/Sediment	8 oz glass jar	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Explosives Water	2 1 L amber glass bottles	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Soil/Sediment	8 oz glass jar	Cool, 4° C	14 days to Ext./ 40 days after Ext.
PCBs/Pesticides Water	2 1 L amber glass bottles	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Soil/Sediment	8 oz glass jar	Cool, 4° C	14 days to Ext./ 40 days after Ext.
Metals Water	1-L high density plastic	Cool, 4° C HNO_3 to pH<2	6 months, Hg 28 days
Soil/Sediment	8 oz glass jar	Cool, 4° C	6 months, Hg 28 days

Holding times start from the date of sample collection in the field.

TABLE 3

ENTRANCE VELOCITY VS WELL YIELD

Well Screen Parameters:	
Screen Diameter:	2 inches
Slot Size:	10 (0.10 inches)
Open Area:	2.75 sq inches/foot of screen

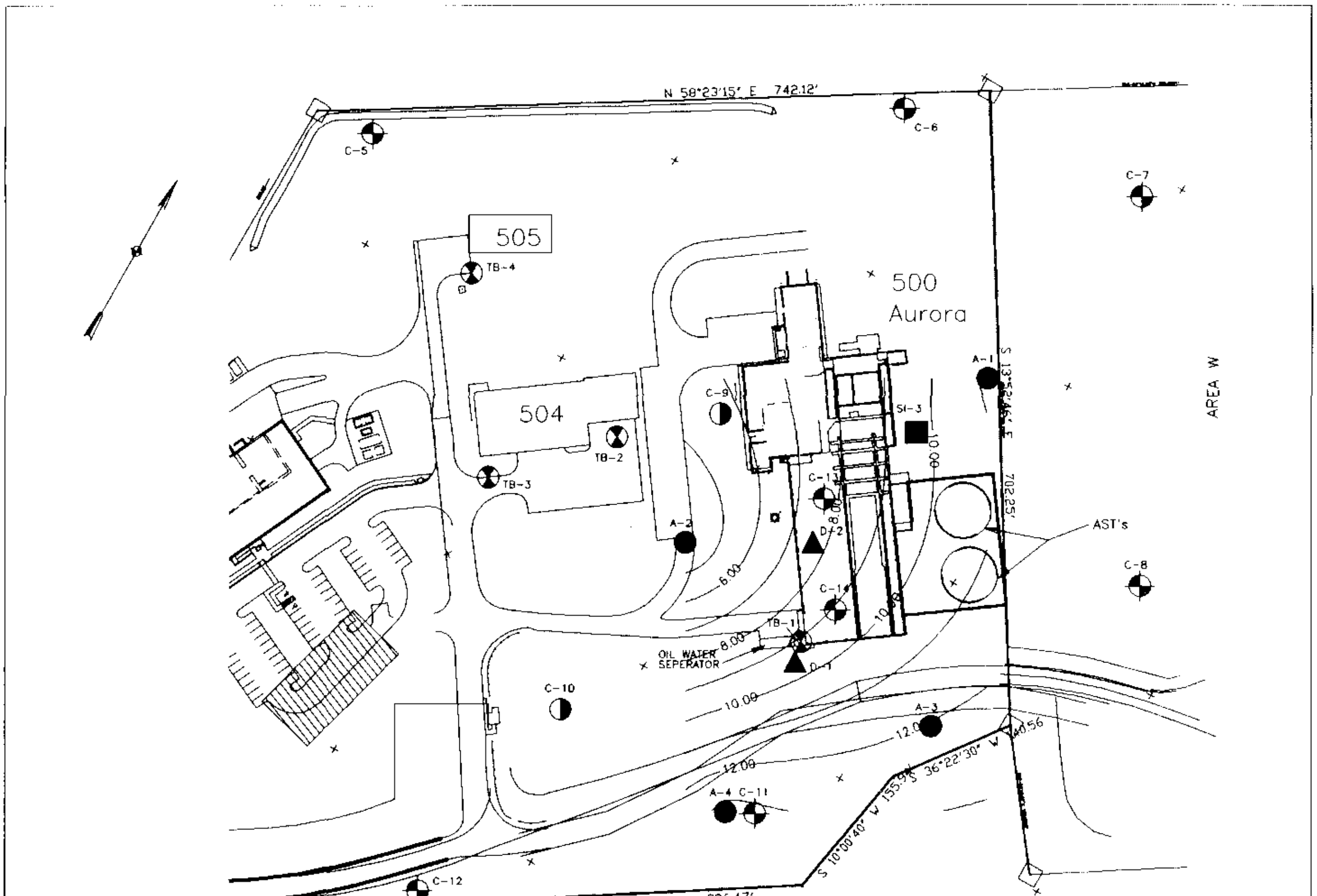
$V = Q/A$

Where: V = Average Entrance Velocity
Q = Yield
A = Open Area of Screen

Height of Water Above Bottom of Screen

1 Foot			2.5 Feet			5 Feet			7.5 Feet			10 Feet		
Yield		Entrance Velocity	Yield		Entrance Velocity	Yield		Entrance Velocity	Yield		Entrance Velocity	Yield		Entrance Velocity
(gpm)	(cfm)	(ft/sec)	(gpm)	(cfm)	(ft/sec)	(gpm)	(cfm)	(ft/sec)	(gpm)	(cfm)	(ft/sec)	(gpm)	(cfm)	(ft/sec)
0.50	0.07	0.0583	0.50	0.07	0.0233	0.50	0.07	0.0117	0.50	0.07	0.0078	0.50	0.07	0.0058
1.00	0.13	0.1167	1.00	0.13	0.0467	1.00	0.13	0.0233	1.00	0.13	0.0156	1.00	0.13	0.0117
1.50	0.20	0.1750	1.50	0.20	0.0700	1.50	0.20	0.0350	1.50	0.20	0.0233	1.50	0.20	0.0175
2.00	0.27	0.2333	2.00	0.27	0.0933	2.00	0.27	0.0467	2.00	0.27	0.0311	2.00	0.27	0.0233
2.50	0.33	0.2917	2.50	0.33	0.1167	2.50	0.33	0.0583	2.50	0.33	0.0389	2.50	0.33	0.0292
3.00	0.40	0.3500	3.00	0.40	0.1400	3.00	0.40	0.0700	3.00	0.40	0.0467	3.00	0.40	0.0350
3.50	0.47	0.4084	3.50	0.47	0.1633	3.50	0.47	0.0817	3.50	0.47	0.0544	3.50	0.47	0.0408
4.00	0.53	0.4667	4.00	0.53	0.1867	4.00	0.53	0.0933	4.00	0.53	0.0622	4.00	0.53	0.0467
4.50	0.60	0.5250	4.50	0.60	0.2100	4.50	0.60	0.1050	4.50	0.60	0.0700	4.50	0.60	0.0525
5.00	0.67	0.5834	5.00	0.67	0.2333	5.00	0.67	0.1167	5.00	0.67	0.0778	5.00	0.67	0.0583
5.50	0.74	0.6417	5.50	0.74	0.2567	5.50	0.74	0.1283	5.50	0.74	0.0856	5.50	0.74	0.0642
6.00	0.80	0.7000	6.00	0.80	0.2800	6.00	0.80	0.1400	6.00	0.80	0.0933	6.00	0.80	0.0700
6.50	0.87	0.7584	6.50	0.87	0.3034	6.50	0.87	0.1517	6.50	0.87	0.1011	6.50	0.87	0.0758
7.00	0.94	0.8167	7.00	0.94	0.3267	7.00	0.94	0.1633	7.00	0.94	0.1089	7.00	0.94	0.0817
7.50	1.00	0.8751	7.50	1.00	0.3500	7.50	1.00	0.1750	7.50	1.00	0.1167	7.50	1.00	0.0875
8.00	1.07	0.9334	8.00	1.07	0.3734	8.00	1.07	0.1867	8.00	1.07	0.1245	8.00	1.07	0.0933
8.50	1.14	0.9917	8.50	1.14	0.3967	8.50	1.14	0.1983	8.50	1.14	0.1322	8.50	1.14	0.0992
9.00	1.20	1.0501	9.00	1.20	0.4200	9.00	1.20	0.2100	9.00	1.20	0.1400	9.00	1.20	0.1050
9.50	1.27	1.1084	9.50	1.27	0.4434	9.50	1.27	0.2217	9.50	1.27	0.1478	9.50	1.27	0.1108
10.00	1.34	1.1667	10.00	1.34	0.4667	10.00	1.34	0.2333	10.00	1.34	0.1556	10.00	1.34	0.1167

FIGURES



(b) (6), (b) (9)

[redacted]

BORING LEGEND

C-5	PROPOSED 2-INCH GROUNDWATER MONITORING WELLS
C-9	PROPOSED 1-INCH WATER OBSERVATION WELLS
A-1	EXISTING MONITORING WELLS (AEHA)
SI-3	PROPOSED SOIL SAMPLES
D-1	PROPOSED FLOOR DRAIN SYSTEM SAMPLE
TB-1	TEST BORINGS

NOTES:

1) D-2 - THE FLOOR DRAIN SUMP INSIDE BLDG 500 WILL BE SAMPLED.

2) C-9 & C-10 WILL BE INSTALLED AS 1-INCH DIAMETER WELLS.

3) SEDIMENT AND SURFACE WATER SAMPLES FROM THE AREA-W DRAINAGE SWALE WILL BE LOCATED IN FIELD.

SCALE: 1 IN.=200 FT.

200 0 200 400

US Army Corps of Engineers

ADELPHI LABORATORY CENTER, MD
REMEDIAL INVESTIGATION AT 500 AREA

U.S. ARMY ENGINEER DISTRICT, BALT.
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

DATE: MAR 1996

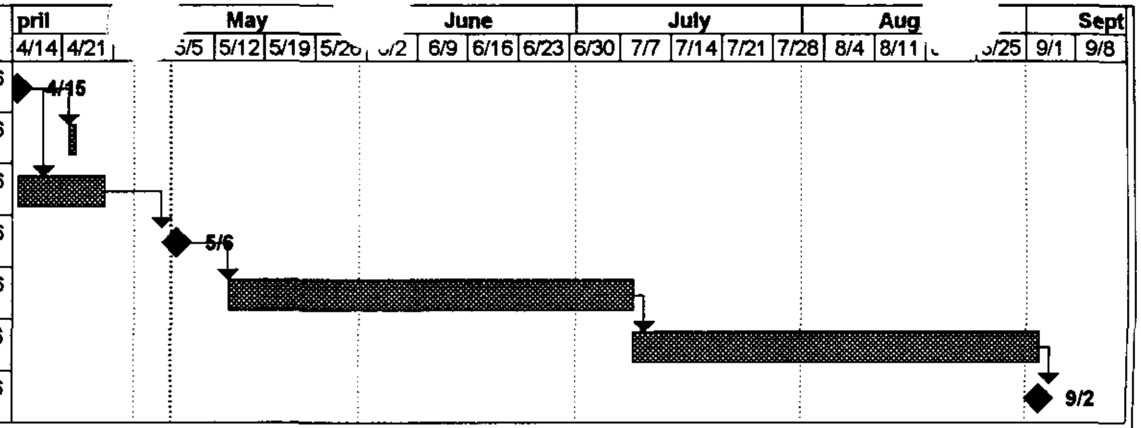
SCALE: AS SHOWN

SHEET:

CADD

FIGURE 1

ID	Name	Duration	Start	Finish
1	Distribute Draft Work Plan	0d	Mon 4/15/96	Mon 4/15/96
2	D. Work Plan Review Meeting	1d	Mon 4/22/96	Mon 4/22/96
3	Draft Work Plan Review	10d	Mon 4/15/96	Fri 4/26/96
4	Distribute Final Work Plan	0d	Mon 5/6/96	Mon 5/6/96
5	Perform Field Work	40d	Tue 5/14/96	Mon 7/8/96
6	Write Draft Report	40d	Tue 7/9/96	Mon 9/2/96
7	Distribute Draft Report	0d	Mon 9/2/96	Mon 9/2/96



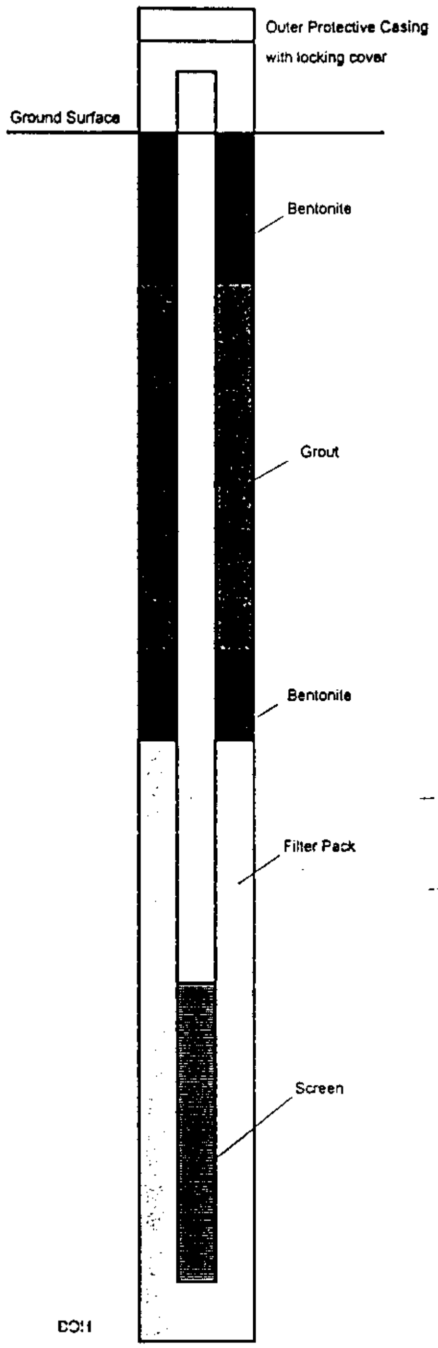
Project: ALC Remedial Investigation
Date: Mon 5/6/96

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

Figure 2

APPENDIX A

HOLE NUMBER:		DRILLER:
PROJECT:	LOCATION:	DRILLING METHOD:
SURFACE ELEVATION:	HOLE LOCATION:	DEVELOPMENT METHOD:
DATE WELL COMPLETED:	DATE DEVELOPMENT COMPLETED:	
INSPECTOR:	DEPTH TO WATER:	DATE:



HEIGHT TO TOP OF RISER PIPE: ______________

TYPE OF SURFACE SEAL: ______________
DEPTH OF SEAL: ______________

I.D. OF SURFACE CASING: ______________
TYPE OF SURFACE CASING: ______________

I.D.OF RISER PIPE: ______________
TYPE OF RISER PIPE: ______________

TYPE OF GROUT: ______________

DEPTH TO TOP OF SEAL: ______________
TYPE OF SEAL: ______________

DEPTH TO TOP OF FILTER PACK: ______________
TYPE OF FILTER PACK: ______________

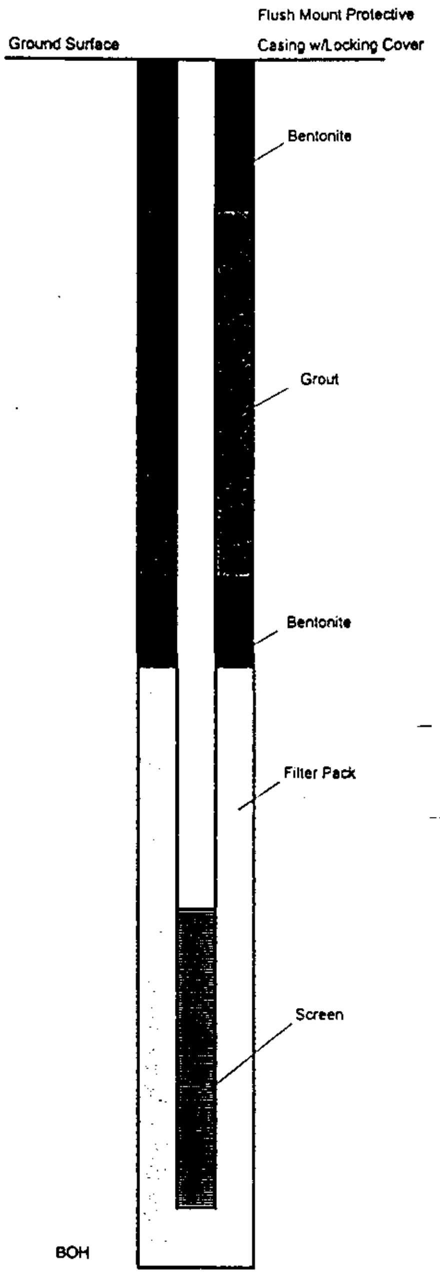
DEPTH TO TOP OF SCREEN: ______________
TYPE OF SCREEN: ______________
SLOT SIZE AND LENGTH: ______________
I.D. OF SCREEN: ______________

DEPTH TO BOTTOM OF SCREEN: ______________
BOREHOLE DIAMETER: ______________

BOTTOM OF HOLE: ______________

FIGURE ---	PROJECT:	HOLE NO.:

HOLE NUMBER:		DRILLER:
PROJECT:	LOCATION:	DRILLING METHOD:
SURFACE ELEVATION:	HOLE LOCATION:	DEVELOPMENT METHOD:
DATE WELL COMPLETED:	DATE DEVELOPMENT COMPLETED:	
INSPECTOR:	DEPTH TO WATER:	DATE:



HEIGHT TO TOP OF RISER PIPE: ______________

TYPE OF SURFACE SEAL: ______________
DEPTH OF SEAL: ______________

I.D. OF SURFACE CASING: ______________
TYPE OF SURFACE CASING: ______________

I.D.OF RISER PIPE: ______________
TYPE OF RISER PIPE: ______________

TYPE OF GROUT: ______________

____

____

____

DEPTH TO TOP OF SEAL: ______________
TYPE OF SEAL: ______________

____

DEPTH TO TOP OF FILTER PACK: ______________
TYPE OF FILTER PACK: ______________

____

DEPTH TO TOP OF SCREEN: ______________
TYPE OF SCREEN: ______________
SLOT SIZE AND LENGTH: ______________
I.D. OF SCREEN: ______________

DEPTH TO BOTTOM OF SCREEN: ______________
BOREHOLE DIAMETER: ______________

____

BOTTOM OF HOLE: ______________

FIGURE —	PROJECT:	HOLE NO.:

APPENDIX B

Well # ________

MONITORING WELL DEVELOPMENT RECORD

.oject: ________
Location: ________
Inspector: ________
Installation Date: ________ Development Date: ________

Well Construction Details		
Total Well Depth	Riser	Screened Interval
Borehole Diameter	Well Diameter	Static Water Level

Method of Development: ________
Pumping Rate: ________
Pump Depth(s): ________
evelopment Start Time: ________ Stop time: ________

Physical Appearance:
Initial ________
During ________
Final ________

.ell Volume (including filter pack): ________

Field Analysis

	Initial	Volume # __	Volume # __	Volume # __	Final
Time					
Conductivity					
pH					
Temperature					

Total Quantity of Water Removed: ________
Method of Water Disposal: ________
Sample Jar Collected: ________

Comments: ________

APPENDIX C

CHEMRON
INCORPORATED
10526 Gulfdale • San Antonio, Texas 78216
(210) 340-8121 (800) 572-6955

COC #: 3922

CHAIN OF CUSTODY RECORD

Chemron's Client	Client's P.O. #
Project Manager:	Phone #:
Address:	FAX #:
Project Number:	Project Name:
Project Location:	Sampler Signature:

ID # LAB USE ONLY	Sampling Date	Sampling Time	Matrix (s,w,f)	Composite	Grab	Boring	FIELD ID #	FIELD DESCRIPTION	No. of Containers	ANALYSIS	BTEX	TRPH					REMARKS (Preservation, Size/Amount, Etc.

Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)

Remarks:

	Yes	No	
Headspace			If Yes, Amt. ______
Properly Sealed			If No, Explain ______
Chilled to 40°F			If No, Temp. ______

Type of Container ______

Additional comments:

APPENDIX D

Slug Test Procedure

Office Preparation for Slug Testing

A) The following steps must be completed inthe office prior to conducting a slug test in the field:

- Obtain well completion records, lithologic logs, and well development records necessary to assist the Project Hydrogeologist in the design of the slug testing program.

- Assemble the equipment and supplies listed on the equipment/ supplies checklist in following table. Ensure the proper operation of all equipment. Record the results of equipment checks in the logbook.

Slug Test Equipment and Supplies Checklist

	Pressure transducers
	Electric water level indicator
	Electronic data logger
	Appropriate size stainless steel or PVC slug
	Duct tape
	Nonwater-soluble black ink marking pens
	Rope (1/8- to 3/16-inch diameter)
	Portable personal computer
	Field logbook
	Clean cloth --
	1-inch PVC pipe and end caps to protect transducer(s) from contaminated water

Slug Testing Field Operations

B) The following steps must be performed to complete a slug test in the field:

1) Ensure proper decontamination of the equipment. Note that solvents and nitric acid should *not* be used on pump, transducers, or transducer cables.

2) Locate the monitoring well to be tested. Verify well identification number. Examine well for evidence of damage, vandalism, or tampering. Note condition of well in logbook. Unlock well and remove cap.

3) Take an initial water level measurement with a water level probe. Record depth to water and well reference point used (e.g., top of inner casing) in the logbook.and on Slug Test Form (STF). See .

4) Plumb depth to bottom of well with water level probe. Record the measurement in the logbook. Determine whether the screened section of the well is fully saturated. Note in the logbook and on the STF.

5) Calculate the standing column of water in the well by subtracting the depth to water from the total depth of the well and multiply by coefficient for well diameter being tested. Record the calculation in the logbook and on the STF.

6) Unpack the data logging equipment. Examine if for visible damage. Check operation of the data logging equipment. Record the results of the equipment check in the logbook.

7) Pad the edges of both the inner and outer well casings to protect the transducer cables from sharp edges.

8) Connect transducer to the data logger.

9) Measure out a length of transducer cable sufficient to lower a transducer to a point approximately 10 feet below the water level measured in the well. The transducer should not be lowered to a depth greater than 1 foot above the measured bottom of the well so that it will not become clogged with sediment.

10) Securely tape the transducer cable with duct tape to the outside of the well protective casing.

11) Enter the required information into the electronic data logger and onto the STF. The type of information may vary depending on the model used. Consult the operator's manual for the proper data entry sequence to be used. the following information must be entered.

- -Well ID
- -Test number
- -Date and time
- -Scale factors and serial numbers for each transducer
- -Initial water level
- -Sampling rate

12) Attach a polyethylene or suitable rope securely to the slug. Measure and mark a length of rope sufficient to lower the top of the slug below the initially measured depth to water. Mark a point on the rope corresponding to where the bottom of the slug will be suspended just above the initial water level. Tie an attachment loop in the end of the rope.

13) Lower the slug into the well to the marked point where the bottom of the slug is suspended just above the initial water level. Attach the rope to the outer well casing.

14) Simultaneously begin collecting data on the electronic logger while lowering the slug smoothly to displace and raise the water level (falling-head slug test). It is important to remove or add the slug as quickly and smoothly as possible because the analysis assumes that an instantaneous change in volume is created in the well.

15) Continue measuring and recording depth-time measurements until the water level returns to approximately 90% of pretest equilibrium conditions, or a sufficient number of readings has been made to clearly show a trend.

16) Reset (step) the data logger, then quickly and smoothly remove the slug from the water (rising-head slug test). Secure the rope to the outer casing and repeat item 15.

17) Stop the data logger operation and remove all equipment from the well. Relock the well.

18) Using a portable computer, download data from the slug test onto a floppy disk.

Data Analysis and Archiving for Slug Testing

C) The following steps must be completed on returning to the office:

- Deliver original logbook, all filled-out Slug Test Forms, and a copy of the data to the Project Hydrogeologist for technical review.

- Inventory the equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to its proper place and report any incidents of malfunction or damage.

- Interpret slug test field results in consultation with the Project Hydrogeologist. Analyze the slug test results using appropriate analytical methods. If notation in the logbook indicates that the well screenis not fully saturated, only the rising-head slug test data should be analyzed.

APPENDIX E

CONSTANT HEAD FIELD PERMEABILITY TEST
FOR HOLLOW STEM AUGER BORINGS

Project Data

Project: ______________________ Date: __________

Location: ______________________

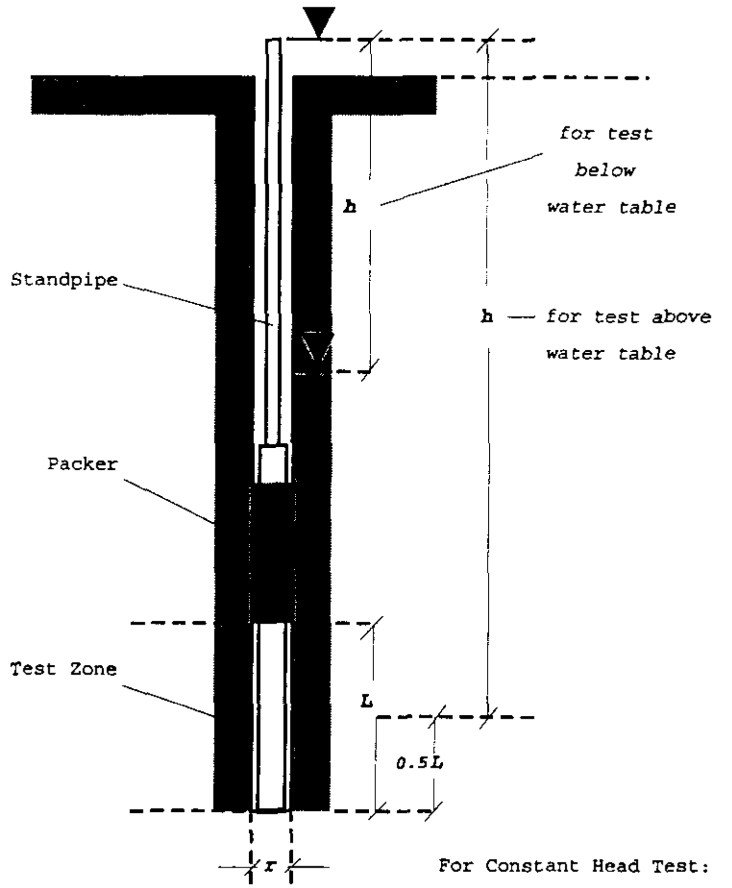
Weather Conditions: ______________________

Test Set Up

Borehole Number:		Length of Probe (total):	
Depth Top of Test Zone:		Measured Stick-up:	
Bottom of Test Zone:		Test above GW Level ?:	
Test Length *L* (feet)		Static Water Level:	
Test radius *r* (inches)		Water Head *h* (feet):	
Flow measurements by:		Remarks:	

Flow measured in gallons				
Trial No.	V (gal)	T (min)	q (gpm)	
1				
2				
3				
4				
avg	0	0		

Flow measured in ml's or cc's				
Trial No.	V (ml)	T (min)	q (cc/sec)	
1				
2				
3				
4				
avg	0	0		



For Constant Head Test:

$k = (q/2\pi Lh)\ \ln(L/r)$

where:

k = permeability

q = flow in volume per unit time

L = length of test section

h = head of water

r = radius of test section

APPENDIX F

FIELD PERMEABILITY TEST PROCEDURE
TESTS PERFORMED THROUGH HOLLOW STEM AUGERS

Prior to beginning packer tests, assemble equipment and inflate packer to check for leaks in the air line and membrane. Also, make sure threads on riser pipe couplings are clean prior to assembling, and that during assembly, go together smoothly and form a water tight joint.

1. Advance borehole to just above desired test zone using 3 1/4" I.D. or larger hollow stem augers.

2. Run Standard Penetration Test using 2" O.D. split spoon just above test zone. Retain sample for mechanical gradation, hydrometer analysis and liquid and plastic limits tests.

3. Measure packer assembly to determine exact depth that drill hole must be advanced below the base of the hollow stem augers. The entire packer membrane must be below the base of the hollow stem augers when inserted into the test hole so that when inflated the packer will provide a tight seal against the borehole wall. If the packer is not fully inserted, damage to the membrane may occur.

4. Advance drill hole below hollow stem augers using a 3 inch diameter flight auger to a depth of __ feet below the base of the hollow stem augers as determined in No. 3 above.

5. Verify test hole is open, thread appropriate number of 1" dia. riser pipe sections together, tape flexible air line to riser pipe sections, measure total length of packer/well point probe and riser pipe and insert packer/well point assembly into test hole. Measure stick-up and make certain assembly goes to bottom of hole, and that the packer is clear of the auger teeth.

5. Connect air line to regulator and inflate packer. For low modulus or thin walled packer membranes such as motor cycle tubes, inflate packer to 1.5 times the water head calculated from the top of the standpipe to the base of the test hole to ensure firm seal against borehole wall when borehole is filled with water. For thick rubber membranes, the packer must be inflated a given amount to overcome the modulus of the rubber before the packer will begin to inflate, plus 1.5 times the water head at a minimum (see table below). Consult the manufacturers handbook for the packer or inflate the packer in air to determine the minimum inflation pressure needed to overcome the strength of the rubber.

6. For tests to be conducted above the water table, or for falling head tests where water is to be added, fill standpipe of packer assembly with clean water to the top of the standpipe and maintain full for a short time period. Check for leaks in the packer (sound of air bubbles or pressure loss at gauge). If a leak is indicated, deflate packer, remove from borehole and repair leak prior to proceeding.

7. Test Methods: Tests below the water table can be run using rising head, falling head or constant head methods. Above the water table, the constant head method can be used to approximate the in-situ permeability. However, the zone of soil surrounding the test hole must be saturated prior to beginning flow measurements. Environmental sampling should not be performed in boreholes in which water is added for permeability testing.

***************** PROCEDURE FOR CONSTANT HEAD TESTS *****************

1. Saturate soils in the test zone by maintaining standpipe full for a minimum period of 15 minutes prior to beginning flow measurements. Run test in three trials and compare result for each interval to evaluate whether or not the degree of saturation of the soils surrounding the test zone is impacting test results. The result for each of the three test intervals should be nearly constant. If not, extend test over a number of trials until a constant result is obtained.

2. Tests may be conducted by measuring flow quantity over a fixed time period, or by introducing a fixed quantity of water over a measured time period. Regardless of method, the water level in the standpipe must be maintained at a fixed level during the entire test. Various methods for performing the tests are outlined below.

METHODS OF FLOW MONITORING
TABLE 1

Method	Where Applied	How to Measure
1. Measure quantity over a fixed time period	a. Soils with low permeability or moderate permeability under very low head	a. Use a calibrated vessel such as a 1 liter beaker and measure water levels in vessel at beginning and end of fixed time period
	b. Soils with moderate to high permeability	b. Use a calibrated vessel such as a 55 gallon drum with a garden hose attached to the base of the drum and some way to measure quantity of water remaining in the drum (calibrated site tube).
2. Measure time to add fixed quantity	Soils with moderate to high permeability	Use a vessel such as a 1 gallon or 5 gallon bucket to add a given quantity of water over a measured time period. Water should be added through a funnel to minimize spills.
3. Flow Meter	Soils with rapid permeability such as clean sands or gravels	Use a hose with a valve at the discharge end to carefully control the flow to maintain standpipe full of water while recording flow quantities at selected time intervals.

TABLE 2
TABLE OF PACKER INFLATION PRESSURES

Water Head* (feet)	Water Pressure (psi)	Inflation Pressure** (psi)
5	2.2	30
10	4.3	30
15	6.5	30
20	8.7	30
25	10.8	30
30	13.0	30
35	15.2	30
40	17.3	30
45	19.5	30
50	21.7	32
55	23.8	36
60	26.0	39
65	28.2	42
70	30.3	45
75	32.5	49
80	34.6	52
85	36.8	55
90	39.0	59
95	41.2	62
100	43.3	65

* Measured from top of standpipe to base of test hole
** Minimum pressure of 30 psi recommended. Pressures given are for thin walled low strength membranes only.

3. Calculations: Permeability for the constant head test performed either above or below the water table is calculated using the following equation:

$$k = (q/2\pi Lh)\ln(L/r), \text{ for } L \geq 10r$$

where:

k = Permeability
q = Volume of water per unit time
L = Test interval (2 feet for packer/well point probe)
r = Radius of borehole in test zone
h = Head of water (measured from the top of the casing to the mid point of the open zone)
ln = natural log

Where the test hole is advanced using the 3 inch flight auger, L, the test length, is 16 times larger than the borehole radius, so $L \geq 10r$ is satisfied.

4. Determination of Flow Measurement Method: Prior to mobilization, flow quantities should be estimated using the above equation and assumed permeabilities based upon best available information. Where flow rates are estimated to be very small, method 1.a from TABLE 1 is recommended. Method 2 may serve as a backup for method 1.a if flow rates are underestimated. Set-ups for methods 1.b and 3 are more elaborate and may work over a much wider range of permeabilities. However, where flow is measured with a flow meter, the flow must be within the linear range of the meter, and the meter should be field calibrated prior to use. Field calibrate the flow meter by measuring the time it takes to fill a 5 gallon bucket or other suitable vessel at a minimum of three different flow rates and plot results.

US Army Corps
of Engineers
BALTIMORE DISTRICT

FINAL QUALITY ASSURANCE PROJECT PLAN

ADELPHI LABORATORY CENTER
REMEDIAL INVESTIGATION AT 500 AREA

ADELPHI, MARYLAND

Project Quality Assurance Officer, CENAB

Quality Assurance Manager, Chemron Inc.

Prepared by:
Engineering Division
U.S. Army Engineer District, Baltimore
10 South Howard Street
Baltimore, MD 21201

May 1996

Remedial Investigation at 500 Area
Adelphi Laboratory Center, Adelphi, MD

QUALITY ASSURANCE PROJECT PLAN

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1.0 PROJECT DESCRIPTION

This document presents the Quality Assurance Project Plan for the Remedial Investigation to be performed at the Adelphi Laboratory Center (ALC) in Adelphi, Maryland. This effort is a continuing investigation of potentially contaminated soil, groundwater and surface water in the vicinity of building 500 at the ALC. The Baltimore District, U.S. Army Corps of Engineers will perform engineering services to characterize the nature, extent, direction, rate, movement, and concentration of hazardous waste and/or hazardous constituents at the facility.

The investigation will include the installation of groundwater monitoring and observation wells; sampling of the proposed and existing monitoring wells; collection and analysis of soil samples obtained from soil borings; collection and analysis of surface water samples and the collection and analysis of sediment samples. The data will then be used to determine nature, extent and source(s) of contamination and potential future actions.

A complete and detailed description of the investigation is available in section 1.0 of the Work Management Plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Activities

BCOE has been authorized to perform the activities described within the Work Management Plan (WMP), Field Sampling Plan (FSP), Site-Specific Safety and Health Plan (SSHP), and the Quality Assurance Project Plan (QAPP). Field work described in this FSP will be covered under a standard QAPP (BCOE-HTRW).

All field work will be performed by the Baltimore District, U.S. Army Corps of Engineers. The geotechnical drilling and sampling for the project will be performed by the Baltimore District's Field Exploration Unit, Geology and Investigations Section (BCOE-FEU).

Analytical testing will be performed by Chemron, Inc., San Antonio, Texas.

Quality assurance testing will be provided by New England Division Environmental Laboratory, U.S. Army Corps of Engineers.

2.2 Personnel

The organizational structure and responsibilities are designed to ensure adequate project control and proper quality assurance for the field program at ALC.

ALC Primary POC:	Robert P. Craig, P.E., Environmental Engineer, Risk Management Division. (301) 394-4511
ALC Alternate POC:	John Feustle, Environmental Engineer, Risk Management Division. (301) 394-4511

Key Baltimore District personnel and their responsibilities are provided below:

Project Manager CENAB-EN-PP-E	Mr. Khal Masoud (410) 962-4448
Design Manager CENAB-EN-HM	Mr. William Thayer (410) 962-6121
Project Hydrogeologist CENAB-EN-GG	Mr. James Spratt (410) 962-6641
Project Geologist CENAB-EN-GG	Ms. Michelle Brock (410) 962-6649
Project Environmental Engineer CENAB-EN-HT	Mr. Gary Schilling (410) 962-3134
Quality Assurance Officer CENAB-EN-HI	Mr. Robert Miller (410) 962-6744
Health and Safety Officer CENAB-EN-HI	Mr. Maurice Wooden (410) 962-6740
Site Safety Officer (SSO) CENAB-EN-HT	Mr. Clint Kneten (410) 962-6743 mobile (410) 962-7680
Field Geologists CENAB-EN-GG	Mr. Lyle Griffith/ Mr. Andrejs Dimbirs (410) 962-4044 (410) 370-1348
Chief, Field Exploration Unit CENAB-EN-GGE	Mr. Bill Kriner (410) 962-4044
Sampling Personnel CENAB-EN-HT	Ken Hilton/Sarah Streeter/Clint Kneten (410) 962-4375/3631/6743

2.3 Responsibilities

Project Manager
- Primary liaison with ALC for project funding and schedule.
- CENAB POC for ALC Installation Restoration Program.
- Notifies ALC POC of changes that may affect the quantity or quality of generated data or costs.

Design Manager
- Liaison with ALC on technical issues.
- Tracks project costs and schedule.
- Ensures project objectives developed by ALC/CENAB are met.
- Coordinates CENAB team.
- Notifies Project Manager of field changes that may affect the quantity or quality of generated data or costs.

Project Hydrogeologist
- Responsible for coordinating all geotechnical branch activity during the project.
- Develops field investigation program that meets the project

objectives.

Project Geologist
- Responsible for the preparation of the FSP, WMP, drilling instructions and RI report.
- Coordinates between geotechnical personnel in the office and field.
- Responsible for verifying that field work complies with WMP and FSP.
- Notifies Design Manager of field changes that may affect the quantity or quality of generated data or costs.

Environmental Engineer
- Responsible for coordinating of all Remedial Investigation and Design (RID) section activity.
- Provides guidance in all areas related to environmental and chemical engineering.

Quality Assurance Officer
- Develops and implements the Quality Assurance Project Plan.
- Coordinates with analytical chemistry laboratories (QA and QC) and reviews laboratory reports.

Health & Safety Officer
- Prepares and coordinates health and safety plan (SSHP).
- Supplies input for specific health and safety problems which may arise during operations.
- Provides oversight of SSO activities.
- Conducts specialized training as required.

Site Safety Officer
- Enforces the SSHP.
- Ensures required safety equipment is on-site, clean and operable.
- Revises equipment requirements or procedures based on new information.
- Coordinates emergency medical response.
- Designates rescue team for supplied air operations.
- Monitors personnel exposures/stress.
- Notifies appropriate emergency personnel in event of accident, fire or explosion.
- Has the authority to cease any operations not in compliance with the SSHP, or which threatens the health or safety of on-site personnel or the general public, or may cause significant adverse impact to the environment.
- Maintains field log containing weather conditions, instrumentation calibration documentation, records of air monitoring and personnel exposure data and other information as required.

Field Geologist
- Directs drilling procedures.
- Prepares drilling logs.
- Establishes and marks site boundaries.
- Coordinates access and security on site.
- Selects the type of drilling equipment and practices to be used.
- Directs drilling procedure.
- Responsible for collecting representative field data and recordkeeping of field activities, describing samples, packaging an shipping samples.
- Notifies Chief, Field Exploration Unit of field changes that may affect the quantity or quality of generated data or costs.

Chief, Field Exploration Unit
- Responsible for coordination of field drilling activities.

- Selects qualified personnel for field team.
- Notifies Project Geologist of field changes that may affect the quantity or quality of generated data or costs.

Sampling Personnel
- Responsible for collecting representative field data and record keeping of field activities.
- Comply with the FSP and SSHP.
- Report unsafe working conditions.

3.0 LABORATORY QUALIFICATIONS

Contract Laboratory: Chemron Inc. is the analytical laboratory for this project and is located in 10526 Guldale, San Antonio, TX 78216. The contract laboratory facilities are capable of providing complete environmental analytical services consistent with USEPA protocols and are validated by USACE. The lab's point of contact is: Ron Oldham at (210)340-8121.

Quality Assurance Laboratory: The Corps of Engineers New England Division Environmental Laboratory will serve as the Quality Assurance lab for this project. QA samples (splits/duplicates field blanks & rinsate) will be shipped by overnight or express mail delivery. The QA lab point of contact is:

Mr. David L. Lubianez
U.S. Army Corps of Engineers Environmental Laboratory
Hubbardston, MA 01452
Telephone (508) 928-4238
Fax (508) 928-5494

4.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to ensure that data of known and acceptable quality are generated. The quality of data is measured through qualitative and quantitative parameters. These parameters are known collectively as the PARCC parameters (Precision, Accuracy, Representativeness, Completeness, and Comparability).

Proper execution of each project task is needed in order to yield consistent information, results that are representative of the media and conditions being measured, and ultimately, data that are useful for meeting the intended project objectives. The analytical laboratory will calculate and report data in units consistent with those of other organizations and agencies to allow comparability of data bases.

The analytical laboratory performs the analyses for specified compounds using standardized methods, and in the process, will generate data to provide a baseline for establishing control limits (for precision, accuracy, reporting limits) for daily analyses.

Methodology - All analytical work shall be conducted using USEPA approved analytical method(s). TABLE 5-1 lists the method(s) to be used for the analysis of respective contaminants.

Units - Volume in liters (L) [e.g., microgram per liter (ug/L)] indicates a water matrix; control spikes are added to organic-free laboratory water. Weight in kilograms (kg) [e.g., milligram per kilogram (mg/kg)] indicates a soil/sediment matrix; laboratory control spikes are added to a standard soil that has been chemically characterized.

4.1 Purpose

The purpose of this QAPP is to specify sampling analytical quality control procedures that will allow the data collected for Adelphi Laboratory Center (ALC), Adelphi, MD to be of sufficient quality in making sound project decisions. The specific quality assurances objectives that are required for the data are developed and identified, through the Data Quality Objectives (DQOs). DQOs take into consideration the intended use of the data, the procedures available for lab and field analysis and the resources available. Once the DQOs for each data collection activity have been established, analytical methods are selected. Specific quality assurance objectives for the analytical methods are then determined.

4.2 Data Requirements

The purpose of this sampling program is to update previous monitoring and investigation data, and to generate additional data required to examine the extent of volatiles, semivolatiles, nitroaromatics and metals contamination in soil/sediments, surface water and groundwater.

The Field Sampling Plan (FSP) has been developed to evaluate the suspected sites as completely, efficiently, and as practically as possible. The FSP describes sampling procedures and analytical methods for the above mentioned matrices. To ensure that the data quality are met, certain DQOs are established for gathered data.

4.3 Data Quality Objectives and Quality Assurance Objectives

The DQOs need to be supported by a certain level of quality which is based on the intended use of the data. The primary use of the generated data is determination of the nature, extent and source(s) of contamination. If warranted, the data may be used to perform a feasibility study or risk assessment. The secondary objective is to update our records of contaminants previously identified at the site (see section 1.0 of the Work Management Plan). Residential Wells monitoring objectives are those identified by EPA and Maryland Department of Environment (MDE) to assure compliance with the Safe Drinking Water Act (SDWA). EPA 8260 method with 25 ml sample purge will be able to achieve drinking water standards. Data will be compared against the Maximum Contaminant Levels established by EPA drinking water standards. Analysis will be performed by laboratory using standard documented procedures. The laboratory is validated by the Corps of Engineers.

4.4 QA Objectives for Measurements

Data assessments and review will be accomplished by the project QA/QC Officer. Problems arising during sample collection, packing, shipping, or analysis will be taken into consideration in the data assessment.

The following procedures will be used to evaluate data precision, accuracy, and analytical completeness for the analyses conducted.

4.4.1 Accuracy

Accuracy will be expressed as percent recovery for laboratory control samples as follows:

$$\text{Percent Recovery} = \frac{X}{T}(100)$$

where X = the observed value of measurement
T = "true" value

These recoveries will be compared with the control limits and the outlier will be assessed in conformance with other QC data. The surrogate recoveries will also be calculated as above and compared against the limits set for the method by SW 846. If the surrogate percent recovery limits are exceeded, the data will be assessed as specified hereafter.

In addition, the matrix spike and matrix spike duplicate sample results will be used to calculate the percent recovery.

$$\text{Percent Recovery (for matrix spikes)} = \frac{X-S}{T} \times 100$$

where X = observed value after spike
S = sample value
T = amount spiked

The matrix spike and matrix spike duplicate percent recoveries will be compared against procedure published limits. Surrogate recoveries will be compared against the method approved limits.

4.4.2 Precision

Precision will be expressed as relative percent difference (RPD) for duplicate environmental samples and for duplicate control samples, as follows:

$$RPD\ (\%) = \{[S-D]/[(S+D)/2]\} \times 100$$

where S = first sample value (original)
D = second sample value (duplicate)

The RPDs will be compared against the published limits specified for the method.

4.4.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent characteristic of a population, parameter variations at a sampling point, or an environmental condition.

Nonhomogenized duplicate samples will be collected and utilized as a means to assess field representativeness. Representativeness will also be maintained during the sampling effort by performing all sampling.

4.4.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability can be related to accuracy and precision as these quantities are measures of data reliability. Data are comparable if silting considerations, collection techniques, and measurement procedures, methods, and reporting are equivalent for the samples within a sample set. A qualitative assessment of data comparability will be made of applicable data sets.

4.4.5 Completeness and Usability

Following validation of the data packages, assessment of the data with respect to fulfillment of quality assurance objectives and usability will be accomplished by the joint efforts of the project chemistry staff. This assessment will include sample collection, sample handling, field data, consideration of blank values and field duplicate values and additional flagging of qualifying data for use at each site.

The analytical completeness will be the ratio of acceptable results to the total number of analytical results requested on sample submitted for analysis. The % completeness will be calculated by multiplying the above ratio by 100.

$$\text{\% Completeness} = \frac{\text{Accepted Analytical Results}}{\text{Total Number of Analytical Results Requests}} \times 100$$

The percent completeness will be compared against the overall program goal for this project. If the goal is not met, the project chemist will decide if the data are sufficient for characterization or other types of data uses. If it is judged that the data are inadequate, additional field samples may need to be collected to accomplish the project goals. Decisions to repeat sample collection and analysis may be made by the project chemist based on the extent of the deficiencies and their importance in the overall context of the project.

The overall analytical completeness goal for ALC is 90%.

4.5 Required Level of Analysis and Review

SW 846 (Inorganic Analysis) will be used to analyze soil/sediment, surface water, and groundwater samples for selected inorganics. The sample preparation/extraction and analysis methods for each procedure are summarized in Table 5-1. EPA method 8260 will be used for testing volatiles (VOC) in ground-water, sediments and soil. The sample bottle, preservation and hold time requirements are summarized in Table 5.5-1.

Level III data documentation will be obtained from the laboratories and will be retained within the project files for a minimum of 2 years from the time of receipt from the laboratory.

4.6 Field QC Checks

Field duplicates, matrix spikes, matrix spike duplicates, field (ambient) blanks, rinsate blanks, and trip blanks will be collected and submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from the field sampling program. Field duplicate samples will be analyzed to check for sampling and laboratory reproducibility. Trip blank samples will be analyzed to check for procedural contamination, cross-contamination, and laboratory contamination during shipment and storage of aqueous samples. Field (ambient) blanks will be used in evaluating contamination as a result of chemical background at this site. Rinsate blanks will be used as a measure of contamination of samples from the sampling equipment. Matrix spike and laboratory control samples will be analyzed to assess if recoveries falling outside acceptance windows are attributable to sample matrix interferences and not to laboratory analytical errors, as well as to measure the accuracy of the analysis. Laboratory duplicates for inorganic analysis and matrix spike duplicates for organic analytes will be analyzed to evaluate laboratory reproducibility or precision.

4.6.1 Field Duplicate

A field duplicate is an environmental sample which is divided into two separate aliquots. The aliquots are processed separately and the results compared to evaluate the effects of the matrix on the precision of the analysis. Results are expressed as relative percent difference (RPD) between the duplicate aliquot analyzed. The RPD should be in the (25-35%) range for water samples, and (35-50%) range for soil samples. Duplicate field samples will be obtained at a rate of 1 per 10 environmental samples or one per batch of samples (which ever is greater) and submitted to the contract lab as blind samples. QA Field duplicates will be designated in the same way, and logged on the chain-of-custody by field sampling personnel as such.

4.6.2 Matrix Spike

A matrix spike (MS) is an environmental sample to which known concentrations of analytes have been added. The matrix spike is taken through the entire analytical procedure and the recovery of the analytes calculated. Results are expressed as percent recovery of the known amount spiked. The matrix spike is used to evaluate the effect of the sample matrix on the accuracy of the analysis. In addition matrix spike duplicates (MSD) will be obtained. In order to verify that poor recoveries (recoveries out of control limits) are due to matrix effect and not lab error for either the matrix spike or the matrix spike duplicate the laboratory will run a blank (deionized water) spiked at the same level as the MS. This analysis is not required to be reported, but the lab must be able to prove that poor spike recoveries are not a result of lab error. Matrix spike analysis will be conducted at a rate of one per matrix per batch of 20 samples, and will be designated on the chain-of-custody by field sampling personnel. Extra sample volume will be collected for matrix spike samples. A determination will be made in the field concerning representative matrices.

4.6.3 Matrix Spike Duplicate

A matrix spike duplicate (MSD) is the same environmental sample as the MS which is spiked with known concentrations of analytes. The two spiked aliquots are processed separately and the results compared to evaluate the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as relative percent differences (RPD) between the duplicate samples analyzed and percent recovery. Matrix spike duplicates will be analyzed at a rate of one per batch of 20 samples, and will be designated on the chain-of-custody by field sampling personnel. Extra sample volume will be collected for matrix spike duplicate samples.

4.6.4 Field Blank

A field blank is a blank sample prepared at the sample collection site and returned to the lab with the samples to be analyzed. A field blank is normally composed of the same matrix being sampled. The field blank measures contamination during sample collection. A field blank is obtained at a frequency of one per day of sampling per matrix and is chosen randomly during a day. Sufficient quantity of a field blank must be prepared to allow the analytical list for that day to be analyzed.

4.6.5 Rinsate Blanks

A rinsate blank is prepared in the field by pouring "clean" deionized, distilled or High Performance Liquid Chromatograph (HPLC) grade water over or through a sample collection device or equipment. A rinsate blank is sometimes referred to as an equipment blank or wash blank. A rinsate blank is prepared at a frequency of one per day of sampling and is analyzed for the analytes being sampled for by the sampling equipment.

4.6.6 Trip Blank

A trip blank is a precleaned and precertified, 40ml VOC sample vial filled with contaminant free water at the laboratory. The trip blank is shipped to and from the field with the sample containers. It is not opened in the field, and therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation and analysis. A trip blank is normally only analyzed for VOC. A trip blank is submitted at a frequency of one per sample cooler sent to the laboratory.

4.6.7 Split Sample

The QC split sample is a Field Duplicate with one portion being shipped blind to Chemron Inc. The QA sample is a field duplicate with one portion being *shipped to the USACE Lab (New England Division Environmental Laboratory) and* the other portion being shipped to the contract Lab. Split field samples results are compared to evaluate precision and accuracy of the primary laboratory analysis. It will be obtained at a ratio of 1 per 10 environmental samples or one per batch and logged and submitted to both labs as blind samples.

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5.0 SAMPLING PROCEDURES AND FIELD DOCUMENTATION

Each sample will be analyzed for the following parameters by the corresponding method number:

Table 5-1
Parameters and Method Numbers

Parameter		Method Number
Target Analyte List metals	(soil/sediment)	EPA SW846
	(groundwater)	" "
	(surface water)	" "
Volatile organics	(groundwater)	EPA method 8260
	(soil/sediment)	" " "
	(surface water)	" " "
Semivolatile organics	(groundwater)	EPA method 8270
	(soil/sediment)	" " "
	(surface water)	" " "
Explosives	(surface water)	EPA method 8330
	(soil/sediment)	" " "
	(groundwater)	" " "
Pesticides/PCBs	(surface water)	EPA method 8081
	(soil/sediment)	" " "
	(groundwater)	" " "

5.1 Surficial Soil Sampling

5.1.1 General Procedures

Procedures for the collection of surficial soil samples are provided in the Field Sampling Plan. Soil sample locations have been carefully chosen to be representative of the areas being investigated. Two areas will have surficial soil sampling, the blowdown area and Site W.

5.1.2 Location

The locations of the soil samples are shown in Field Sampling Plan.

5.2 Soil Boring Sampling

5.2.1 General Procedures

One soil sample per boring shall be analyzed for volatiles and semivolatiles. The sampling column portion that exhibits the highest Photo Ionization Detector (PID) reading shall be selected for the volatiles and semivolatiles test.

5.2.2 Location

Locations for soil borings are specified in the Field Sampling Plan.

5.3 Surface Water/Sediment Sampling

5.3.1 General Procedures

Surface water samples shall be obtained by collecting grab samples, taking care not to disturb sediments at the sampling point. Complete instruction for sample collection is provided in the Field Sampling Plan.

5.3.2 Location

Three surface water samples will be taken concurrent with three sediment samples from Site W drainage swale. The surface water/sediment sampling will be concurrent with groundwater sampling. Surface water and sediment samples shall be tested for volatiles VOA (SW-846 method 8260, semivolatiles SVOC (SW-846 method 8270), pesticides and PCBs (SW-846 method 8081), explosives (SW-846 method 8330) and dissolved TAL metals (SW-846).

5.4 Groundwater Sampling

5.4.1 General Procedures

All groundwater sampling will occur at least 14 days after the wells have been developed, to allow the natural groundwater to reach chemical equilibrium. Region III Guidelines state that both filtered and unfiltered samples will be collected for the determination of dissolved and total metals. Sample filtration procedure will be performed in the field.

5.4.2 Location

5.4.2.1 Monitoring Wells

A total of eight monitoring wells, two inside building 500 and six outside building 500, will be installed. One grab sample per well shall be collected from the new monitoring wells. The samples shall be analyzed for volatiles, semivolatiles, pesticides and PCBs, dissolved and total TAL metals and explosives to identify type and extent of groundwater contamination.

5.4.2.2 Existing Monitoring Wells

To update the chemical monitoring data, one grab sample will be collected from the existing four wells. The samples shall be analyzed for volatiles, semivolatiles, pesticides and PCBs, dissolved and total TAL metals and explosives.

5.4.2.3 Residential Wells

To update data, and continue monitoring efforts, both the [redacted] and [redacted] residential wells will be sampled concurrently with the monitoring well sampling. Samples will be analyzed for volatiles, semivolatiles, pesticides and PCBs, dissolved and total TAL metals and explosives.

Table 5-2
SUMMARY OF LABORATORY TEST
ALC SOIL SAMPLING MATRIX

Media/Location	VOAs SW-846 8260	SVOCs SW-846 8270
Soil Borings	4	4
Blowdown Area Soil Samples	1	1
Splits Duplicates QC (Chemron)	1	1
QA (NED Lab)	1	1
Total NED Samples	1	1
Total Chemron Samples	6	6

Table 5-3
SUMMARY OF LABORATORY TEST
ALC SURFACE WATER/SEDIMENT SAMPLING MATRIX (AREA W)

Media/Location	VOAs SW-846 8260	SVOCs SW-846 8270	Explosives SW-846 8330	PCBs/Pesticides SW-846 8081	TAL Metals Dissolved SW-846
Site W (sediment)	3	3	3	3	3
Splits (sediment) QC (CHEMRON Lab)	1	1	1	1	1
Site W (surface water)	3	3	3	3	3
Splits(surface water) QA (NED Lab)	1	1	1	1	1
Trip Blanks QC (Chemron)	1				
QA (NED Lab)	1				
Total NED Samples	2	1	1	1	1
Total Chemron Samples	8	7	7	7	7

TABLE 5-4
SUMMARY OF LABORATORY TEST
ALC GROUNDWATER AND FLOOR DRAIN WATER SAMPLING (BLDG. 500)

Media/ Location	VOAs SW-846 8260	SVOCs SW-846 8270	Pest/PCBs SW-846 8081	Explosives SW-846 8330	TAL Metals Dissolved SW-846	TAL Metals Total SW-846
Monitoring Wells	8	8	8	8	8	8
GW Splits/Dup. QC (Chemron)	1	1	1	1	1	1
Existing Monitoring Wells	4	4	4	4	4	4
Floor Drains	2	2	2	2	2	2
DRAIN Splits QC (Chemron)	1	1	1	1	1	1
Residential Wells	2	2	2	2	2	2
QA (NED Lab)	1	1	1	1	1	1
Trip Blanks QC (Chemrom)	3					
QA (NED Lab)	1					
Total NED Samples	VOA trip 2	1	1	1	1	1
Total Chemron Samples	22	18	18	18	18	18

5.5 Field Activities and Sample Custody

The following equipment will be used to complete the specified field activities:

5.5.1 Sampling Equipment and Supplies

Stainless Steel Spatulas & Spoons
Stainless Steel Bowls
Split Spoon Samplers
Drilling Equipment
Well/concrete pad materials
Field Notebook
Chain of Custody Forms
Inspector's Daily Report forms
Boring Log Forms (Eng Form 1836), well completion/development forms
Marking Pens (waterproof)
Camera and Film
One-gallon Ziploc Bags
Bubble Wrap/Packing Material (Vermiculite)
Coolers with Ice/Pack
Engineer's ruler, measuring tape
Custody Tape, strapping tape
Geotech sample jars

Sample containers (Lab provided)
Sample container labels
PPE as specified in SSHP
PID w/ calibration gas
Combustible gas indicator
pH/Conductivity/Temp meter, pH calibration solutions
Water level indicator
LNAPL Indicator

5.5.2 Decontamination Equipment and Supplies:

Phosphate free detergent
Methanol (HPLC grade)
Nitric Acid (1% soln)
Scrub Brushes
Steam Cleaning Trailer
Nalgene Squirt Bottles
Trash Bags
Potable Water Dist./Deionized Water
Plastic Wash Tub (5)
Paper Towels
Polyethylene Sheeting
Five gallon buckets

5.5.3 Sample Containers:

The quantity and types of sample containers required for the various sample matrices and respective analytical parameters are listed in Table 5.5-1 below. All containers must be precleaned, have Teflon-lined seals and will be supplied by the laboratory. When both organic and inorganic substances are to be analyzed separate samples will be taken.

5.5.4 Sample Preservation

After collection of each sample, the sample will be preserved with the appropriate preservative(s) for the sample matrix and parameter to be analyzed. Table 5.5-1 contains a listing of containers and preservatives to use, and maximum holding times for each type of sample collected for this project.

TABLE 5.5-1
CONTAINERS, PRESERVATION, and HOLDING TIMES

Analysis	Containers	Preservation	Holding Times
Volatiles Water	3 40mL amber glass VOA vials, Teflon-lined cap	Cool, 4° C HCl to pH<2	14 days
Soil/Sediment	2 40mL glass VOA vials, Teflon-lined cap	cool, 4° C	14 days
Semivolatiles Water	2 1 L amber glass bottles	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Soil/Sediment	8 oz glass jar	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Explosives Water	2 1 L amber glass bottles	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Soil/Sediment	8 oz glass jar	Cool, 4° C	14 days to Ext./ 40 days after Ext.
PCBs/Pesticides Water	2 1 L amber glass bottles	Cool, 4° C	7 days to Ext./ 40 days after Ext.
Soil/Sediment	8 oz glass jar	Cool, 4° C	14 days to Ext./ 40 days after Ext.

Metals Water	1 L high density plastic	Cool, 4° C HNO_3 to pH<2	6 months, Hg 28 days
Soil/Sediment	8 oz glass jar	Cool, 4° C	6 months, Hg 28 days

Holding times start from the date of sample collection in the field. Preservatives for geotechnical samples will be identified in the Field Sampling Plan.

5.5.5 Field Documentation

5.5.5.1 Field personnel will be required to keep a field logbook documenting all field activities. The logbook will be a bound notebook with water resistant pages. Logbook entries shall be dated, legible, and contain accurate and inclusive documentation of the activity. The following guidelines will be used when entering information into a logbook:

See section 5.1 of the Field Sampling Plan

5.5.5.2 A photographic record will be made for the drilling and sampling completed at each boring. Photographs will be annotated as outlined in the Field Sampling Plan, section 5.2.

5.5.6 Sample Designation/Identification

All samples, including QC duplicates, collected during the field investigation will be identified and labeled with a site specific sample identification code. The site specific sample code will be based on the following system:

AL - Site designation: Adelphi Lab

MP10 - Number refers to boring number (MP-10)

S/W - Letter refers to sample type (Soil or Water)

xx - Numbers refer to sample number (01 to 23)

Note: For each of the two QC split samples collected, label the sample using the identification code system as outlined above. However, make a notation in the field logbook as to which samples were collected as QC splits.

This site specific sample ID code shall be recorded in indelible ink on the sample label and the chain of custody form accompanying each sample submitted to the laboratory for analysis.

5.5.7 Quality Control Summary Report (QCSR)

For this confirmation study, upon completion of field activities at the site, a separate QCSR will be completed, dated and signed by the site manager to be included in the final report. A copy of this QCSR will be sent to the HTRW Branch project chemist for review. These reports shall include at least the following information:

a. Samples collected, including the dates collected.

b. Weather conditions encountered at time of sampling.

c. Any deviations from the QAPP, problems identified, corrective actions taken, observations made.

These reports may be generated from information recorded in the field logbook by the field team leader. Evidence of the sample traceability from collection, to shipment, to laboratory receipt, and laboratory custody until proper disposal must be documented.

5.5.8 Chain of Custody

A sample is considered to be in a person's custody if the sample is:

a. In a person's actual possession
b. In view after being in a person's possession
c. Locked up so that no one can tamper with it after having been in physical custody
d. In a secured area, restricted to authorized personnel

The chain of custody procedures are initiated in the field following sample collection. The procedures consist of:

a. Preparing and attaching a unique sample label to each sample collected
b. Completing the chain of custody form
c. Preparing and packaging the samples for shipment

5.5.8.1 Sample Labels

Field personnel are responsible for uniquely identifying and labeling all samples collected during a field investigation. All labeling will be completed in indelible ink and be securely affixed to the sample container. All sample bottles shall be labeled containing the following information:

a. CENED project number (E0567) and site name
b. Unique sample identification number
c. Sample description
d. Parameters to be analyzed for
e. Sampling date and time
f. Initials of sampling technician
g. Method of sample preservation/conditioning used

5.5.8.2 Chain of Custody Form

Documentation will be accomplished through a chain of custody form that records each sample and the individuals responsible for sample collection, transfer, shipment, and receipt by the laboratory. This form must also contain pertinent information about sampling location, date, and times, signature of sampling technician, types and numbers of samples collected and shipped for analysis in each lot, parameters to be analyzed per sample (including project unique specific sample preparation or extraction methods/detection limits), unique sample identification numbers assigned to the sample(s), and the project name and number (E0567).

Samples shall be accompanied by an approved and completed chain of custody form during each step of custody, transfer, and shipment. When physical possession of samples is transferred, both the individual relinquishing the samples and the individual receiving them shall sign, date, and record the time on the chain of custody form. The sample custodian will receive the samples at the contract laboratory. The sample custodian will receive the samples at the New England-QA laboratory.

For samples shipped via overnight carrier to the laboratory, the person relinquishing custody of the samples to the overnight carrier shall sign the custody form, noting that custody is relinquished to the carrier, and noting the air bill number of the shipment and date, time on the form. The person receiving the samples from the carrier shall sign for custody of the samples, indicating that samples were received from the carrier and also noting the air bill number and date, time of receipt.

It is important to note that only one site is listed per form even if the sites have the same project number. An example chain of custody record form is contained in Appendix C at the end of the Field Sampling Plan.

5.5.8.3 Sample Packing and Transportation

Samples will be placed in individual containers compatible with the intended analysis, properly preserved, and sealed with a Teflon-lined screw cap prior to shipment to the laboratory. Sample labels, field notebook information, and chain of custody forms are checked to be sure there are no errors in sample identification and to verify that all the required information has been supplied. The samples are then packaged to prevent breakage and/or leakage.

As soon as field personnel are ready to transport samples from the field to the contract laboratory, the laboratory point of contact (POC) shall be notified by telephone of the shipment along with the estimated time of arrival.

No chemical analytical samples shall be held on site for more than 48 hours. All samples will be shipped to the designated laboratory in sealed coolers via overnight carrier or delivered in person.

5.5.8.4 Sample Packing Instructions

In order to maintain chain of custody protocol as well as to prevent breakage of the sample containers, the packaging procedures shall be as follows:

a. Secure the lids of properly labeled samples with strapping tape.

b. Place approximately a 3-inch layer of inert cushioning material (e.g. vermiculite) in the bottom of a waterproof metal or equivalent strength plastic ice chest or cooler.

c. Enclose the bottles in clear plastic bags, through which labels are visible, and seal the bag. Place the bottles upright in the cooler so they do not touch and will not touch during shipment.

d. Put in additional packing material to partially cover sample bottles (more than halfway), to ensure that they do not shift during transport.

e. Place sealed plastic bags of ice (double bagged) in ziplocs around and on top of the samples bottles. If chemical ice is used (i.e. blue ice), it should be placed in a plastic bag. NOTE: Use sufficient quantity of ice in order to maintain samples cool during shipment at a temperature of 4°C.

f. Seal the appropriate chain of custody form(s) in a ziploc plastic bag, and tape it securely to the inside lid of the cooler.

ORIGINAL (Red)

g. Tape the drain shut.

h. Close and lock/latch the cooler. Secure the lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.

i. Attach completed shipping label to top of the cooler.

j. Put "This Side Up" labels on top of the cooler and "Fragile" labels on at least two sides.

k. Affix numbered and signed custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

While packing each cooler for shipment, remember not to exceed the weight limit set by the shipper.

6.0 LABORATORY ANALYTICAL PROCEDURES

6.1 Analytical Methods

All environmental samples collected for analysis will be sent to the designated laboratory for this project. The designated laboratory to perform analytical sample analyses for this project is Chemron Inc. (a USACE validated laboratory). Samples will be analyzed by using EPA approved methods.

6.1.1 Volatile Organic Compounds (VOCs) Analysis

Volatile organics include several classes of organic compounds such as halogenated and nonhalogenated aliphatic, as well as aromatics. Aliphatic halogenated volatiles and aromatics like BTEX compounds are known contaminants at the site.

6.1.1.1 Soil, Surface Water and Groundwater Samples

Method 8260 will provide data on the volatile constituents.

6.1.1.2 Method Specific Data Quality Objectives

Method 8260 is a gas chromatography/mass spectroscopy GC/MS method which uses a purge and trap system with thermal desorption to introduce the sample into the system. The GC/MS will acquire data in total ion current (TIC) mode to give both qualitative and quantitative information. Both systems will be calibrated using a five-point calibration with standards specific to the compounds of interest.

6.1.2 Semivolatile Organic Compounds (SVOCs) Analysis

A table of analyte specific sample preparation procedures that may be used is given in Method 8270. The two procedures that covers most of the analytes are 3510 and 3580.

6.1.2.1 Soil Samples

Method 8270A will provide data on the semivolatile constituents.

6.1.2.2 Method Specific Data Quality Objectives

Method 8270A is a gas chromatographic/mass spectroscopy GC/MS. Prior to using this method, the samples should be prepared for chromatography using the appropriate sample preparation and cleanup methods. This method describes chromatographic conditions for the separation of the compounds in the extract. Both systems will be calibrated using a five-point calibration with standards specific to the compounds of interest.

6.1.3 Nitroaromatics and Nitroamines (Explosives Residues)

Method 8330 is for trace analysis of explosives residues by high performance liquid chromatography using a UV detector. This method is used to determine the concentration of compounds used in the manufacture of explosives or the degradation products of compounds used for that purpose. The system will be calibrated using a five-point calibration with standards of the compounds of interest. The analytes of water and their detection limits for low level explosives are listed below:

Compound	Detection Limit (ug/L)
2,6-dinitrotoluene (2,6-DNT)	0.0070
2,4-dinitrotoluene (2,4-DNT)	0.10
2,4,6-trinitrotoluene (2,4,6-TNT)	0.10
RDX	0.30
HMX	6.0

6.1.4 Polychlorinated Biphenyls (PCBs)

Method 8081 is for analysis of polychlorinated biphenyls by capillary Gas Chromatography using an electron capture detector (ECD). Compound identification based on a single column analysis should be confirmed on a second column. Some pesticide interferences can be removed by sulfuric acid/permanganate cleanup (method 3665) and silica fractionation (method 3630). PCBs should be quantitated using the "PCB" quantitation option #1 by comparing the total area of the chlorinated biphenyl peaks to the total area of the appropriate Arochlor reference material. Use only those peaks from the sample that can be attributed to chlorobiphenyls. These peaks must also be present in the chromatogram of the reference materials.

REPORTING LIMITS	Water	Soil
Arochlor - 1242	0.50 ug/L	17 ug/kg
Arochlor - 1248	0.50 ug/L	17 ug/kg
Arochlor - 1254	0.50 ug/L	17 ug/kg
Arochlor - 1260	0.50 ug/L	17 ug/kg

6.1.5 Inorganic Analysis

6.1.5.1 Soil and Groundwater Samples

Methods 3005/6010 may be used for the analysis of the TAL metals (with the exception of arsenic, selenium, mercury, lead) in water (SW846, 3rd Edition update). Arsenic, selenium, and lead shall be analyzed by the respective graphite furnace methods 3050/7060, 3050/7740, and 3050/7421 unless they are present at sufficient concentration to be detected by ICP (3005/6010). Thallium shall be analyzed using method 7841. Sufficient concentration will be defined as being greater than three times the instrument detection limit (IDL)

Method 8270A is a gas chromatographic/mass spectroscopy GC/MS. Prior to using this method, the samples should be prepared for chromatography using the appropriate sample preparation and cleanup methods. This method describes chromatographic conditions for the separation of the compounds in the extract. Both systems will be calibrated using a five-point calibration with standards specific to the compounds of interest.

6.1.3 Nitroaromatics and Nitroamines (Explosives Residues)

Method 8330 is for trace analysis of explosives residues by high performance liquid chromatography using a UV detector. This method is used to determine the concentration of compounds used in the manufacture of explosives or the degradation products of compounds used for that purpose. The system will be calibrated using a five-point calibration with standards of the compounds of interest. The analytes of water and their detection limits for low level explosives are listed below:

Compound	Detection Limit (ug/L)
2,6-dinitrotoluene (2,6-DNT)	0.0070
2,4-dinitrotoluene (2,4-DNT)	0.10
2,4,6-trinitrotoluene (2,4,6-TNT)	0.10
RDX	0.30
HMX	6.0

6.1.4 Polychlorinated Biphenyls (PCBs)

Method 8081 is for analysis of polychlorinated biphenyls by capillary Gas Chromatography using an electron capture detector (ECD). Compound identification based on a single column analysis should be confirmed on a second column. Some pesticide interferences can be removed by sulfuric acid/permanganate cleanup (method 3665) and silica fractionation (method 3630). PCBs should be quantitated using the "PCB" quantitation option #1 by comparing the total area of the chlorinated biphenyl peaks to the total area of the appropriate Arochlor reference material. Use only those peaks from the sample that can be attributed to chlorobiphenyls. These peaks must also be present in the chromatogram of the reference materials.

REPORTING LIMITS	Water	Soil
Arochlor - 1242	0.50 ug/L	17 ug/kg
Arochlor - 1248	0.50 ug/L	17 ug/kg
Arochlor - 1254	0.50 ug/L	17 ug/kg
Arochlor - 1260	0.50 ug/L	17 ug/kg

6.1.5 Inorganic Analysis

6.1.5.1 Soil and Groundwater Samples

Methods 3005/6010 may be used for the analysis of the TAL metals (with the exception of arsenic, selenium, mercury, lead) in water (SW846, 3rd Edition update). Arsenic, selenium, and lead shall be analyzed by the respective graphite furnace methods 3050/7060, 3050/7740, and 3050/7421 unless they are present at sufficient concentration to be detected by ICP (3005/6010). Thallium shall be analyzed using method 7841. Sufficient concentration will be defined as being greater than three times the instrument detection limit (IDL) for ICP. Mercury will be analyzed using method 7470, which is a cold-vapor atomic absorption (CVAA) procedure.

7.0 CALIBRATION AND FREQUENCY

Preparation and maintenance of standards and reagents used in the analytical operations will be performed per the specified methods using a 5-point calibration. The contract laboratory shall continuously monitor the quality of reagents and standard solutions through a series of well-documented procedures.

8.0 INTERNAL QC CHECKS

The overall QA objective is to implement QC procedures during laboratory analysis and reporting that will provide data to the degree of quality consistent with their intended use. These specific ranges or criteria, at a minimum, will be equivalent to those specified in SW-846.

8.1 Method Specific Data Quality Objectives

Analyses for TAL metals will be completed to within an accuracy range of 75-125% recovery, with a precision of 20% RPD for both soil and water samples.

Soil shall be calculated and reported on a dry weight basis. Detection limits must meet or exceed the low levels parameters established by EPA and State of Maryland as specified in SW-846 methods and referenced in Method Detection Limits. To achieve lower detection limit for volatile analytes, increasing sample volume or extract purge is authorized.

When errors, deficiencies or out-of-control situations exist, the contract laboratory's QA plan shall provide systematic procedures, which shall be implemented to resolve problems and restore proper functioning to the analytical system. The contract laboratory shall notify the USACE chemist of this problem for proper resolution.

9.0 CALCULATION OF DATA QUALITY INDICATORS

Precision will be expressed as relative percent difference (RPD) for duplicate environmental samples and for duplicate control samples, as follows:

$$\text{RPD } (\%) = \{[S-D]/[(S+D)/2]\} \times 100$$

where S = first sample value (original)
D = second sample value (duplicate)

The RPDs will be compared against the published limits specified for the method.

Accuracy will be expressed as percent recovery for laboratory control samples as follows:

$$\text{Percent Recovery} = \frac{X}{T}(100)$$

where X = the observed value of measurement
T = "true" value

These recoveries will be compared with the control limits and the outlier will be assessed in conformance with other QC data. The surrogate recoveries will also be calculated as above and compared against the limits set for the method by SW 846. if the surrogate percent recovery limits are exceeded, the data will be assessed as specified hereafter.

10.0 CORRECTIVE ACTIONS

10.1 Departure From Approved Plans

These reports shall include problems identified, corrective actions, and verbal/written instructions from USACE personnel for sampling or re-analysis. Written reports of all significant problems shall be sent to the USACE project manager within 48 hours of the occurrence.

11.0 DATA REDUCTION, VALIDATION AND DOCUMENTATION

Data validation shall be performed in accordance with the procedures of the USACE approved Laboratory's QA manual and shall adhere to the protocols described in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition, U.S. EPA, November 1990.

12.0 INSTRUMENT PREVENTATIVE MAINTENANCE

The analytical instrumentation to be used for sample analysis shall have preventive maintenance performed and calibrations done at a frequency which is specified and in accordance with the procedures documented in the Laboratory's QA Manual. These shall be consistent with the requirements of the analytical method.

13.0 ANALYTICAL DATA REPORT/PACKAGE TO THE USACE

The contractor's data must be submitted as a pre-draft final report to the USACE Project Chemist for comparison and evaluation between the data generated from the contractor's internal QC and results obtained from the field duplicate/split samples. This review also encompasses an assessment of the internal quality control and method requirements, enabling a validation of the data generated during the project to be performed. As mentioned in section 4.5, the data package will be a Level III data documentation deliverable. This package of data shall be submitted as soon as it becomes available. The data set shall also be reviewed for completeness and verification that the DQOs were met.

This deliverable shall also contain all of the items listed below to allow the USACE chemist to perform an adequate evaluation (Data shall be presented in tabular format whenever possible):

a. Sample Identification - Prepare a tabular presentation which matches the contract laboratory sample identifications to the field sample identification numbers assigned to each sample. This table shall identify all field splits/duplicates as such and shall match with their corresponding field samples where applicable.

b. Cooler Receipt Forms - Provide copies from all sample shipments received at the contract laboratory.

c. Chain of Custody Record Forms - Provide copies from all sample shipments to the contract laboratory.

13.1 Final Site Confirmation/Inspection Report:

This report will include a summary of work done, departures from the QAPP, analytical results, field observation, and regulatory or action level factors which impact on decisions to be made as a result of the investigation.

US Army Corps
of Engineers
BALTIMORE DISTRICT

FINAL SITE HEALTH AND SAFETY PLAN

ADELPHI LABORATORY CENTER
REMEDIAL INVESTIGATION AT 500 AREA

ADELPHI, MARYLAND

Prepared by:
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May 1996

APPROVAL PAGE
SITE HEALTH AND SAFETY PLAN
REMEDIAL INVESTIGATION AT 500 AREA
ADELPHI LABORATORY CENTER
ADELPHI, MARYLAND

<u>Signature</u> <u>Date</u>

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SITE HEALTH AND SAFETY PLAN

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1.0 INTRODUCTION

The Remedial Investigation (RI) that this site specific health and safety plan (SSHP) addresses will occur at the Adelphi Laboratory Center (ALC) located in Adelphi, Maryland. The Army Research Laboratory (ARL) is a large system of laboratories throughout the country, the location in Adelphi is specifically known as the Adelphi Laboratory Center (ALC).

1.1 Background

The ALC is a facility that develops electronic fuses for projectiles, missiles and associated technology. The facility has performed research on fluidics and nuclear weapons effects technologies. Operations which support this mission have included metals plating, an impulse generator, photographic operations, and production of printed circuit boards. All operations with the exception of the Aurora Facility (building 500) are on a small test scale. Building 500 houses test equipment for nuclear simulation experiments. A generator used in testing has a capacity of approximately 1.4 million gallons of non-PCB insulating oil. Several documented spillages of the insulating oil have occurred inside Bldg. 500.

Environmental investigations in 1984 at the adjacent Naval Surface Warfare Center (NSWC) concluded that seven of the fourteen sites investigated at NSWC posed a potential threat to human health and the environment sufficient to warrant further study. Environmental investigations in 1992 on ALC property found a small quantity of oil-contaminated soil along the northeast side of building 500.

Environmental investigations in 1994 concerning Bldg. 500 areas found drinking water standards slightly exceeded in groundwater for the compounds of thallium, nickel, trichloroethene and dichloromethane. Low levels of petroleum hydrocarbons were also present in groundwater and in the monitoring well upgradient of Bldg. 500. Additionally, elevated levels of the explosive compound RDX was found in surface water samples east of Bldg. 500. Further investigations of the ground and surface waters in the vicinity of building 500 is warranted.

1.2 Location

ALC is located in Maryland approximately five miles northeast of the Washington, D.C. city limits. The installation covers about 159 acres of Prince Georges and Montgomery Counties with 76 acres located in Prince Georges County. Building 500 is located in Prince Georges County. The site consist of gently rollng to hilly terrain with some outcrops of bedrock. The installation is drained by Paint Branch creek which flows southeasterly across the area. Portions of ALC are heavily wooded and is surrounded by essentially residential areas.

SSHP-1 Washington, D.C. and Vicinity Map

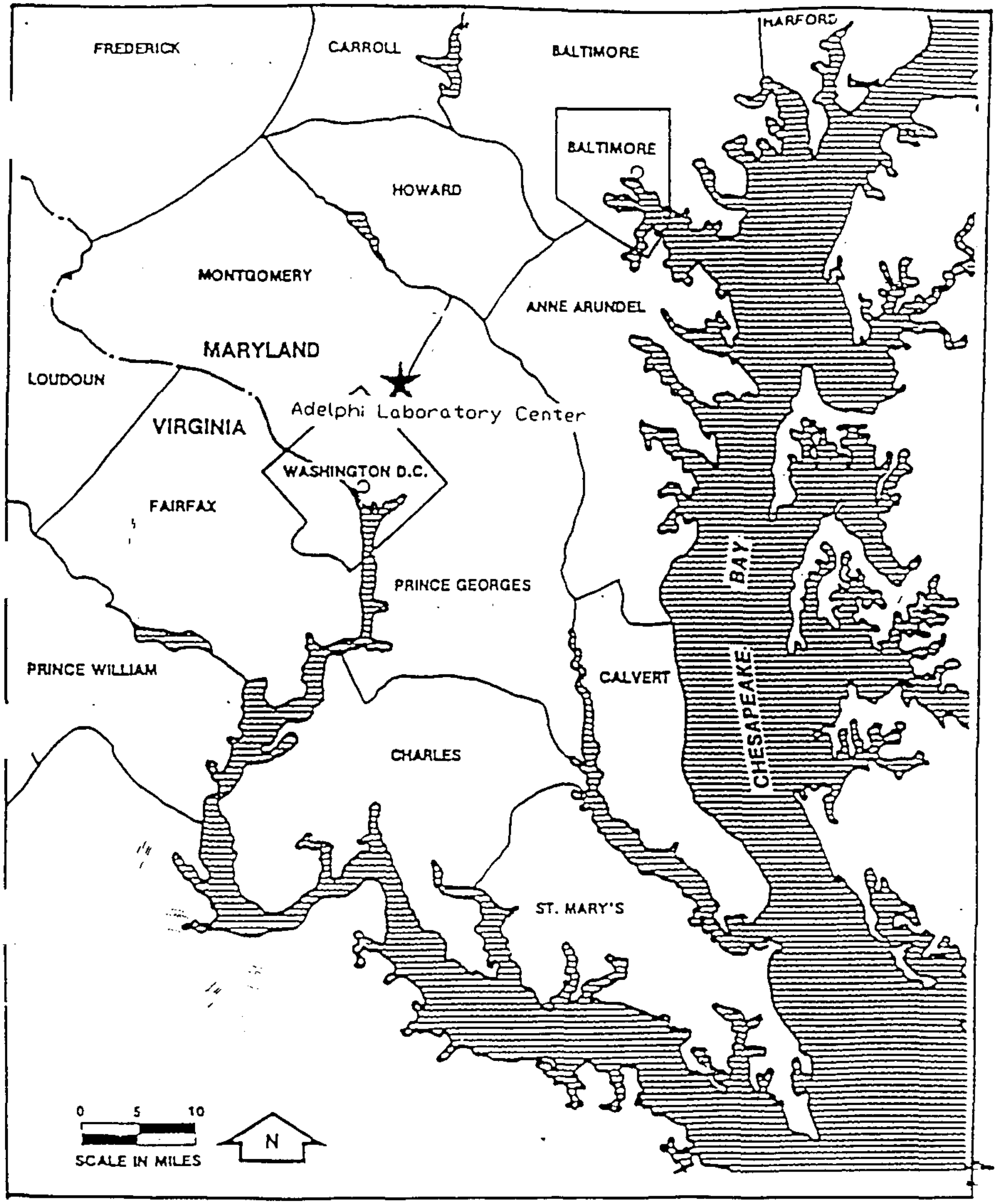


Figure 1: Location map of Adelphi Laboratory Center, Adelphi, Maryland.

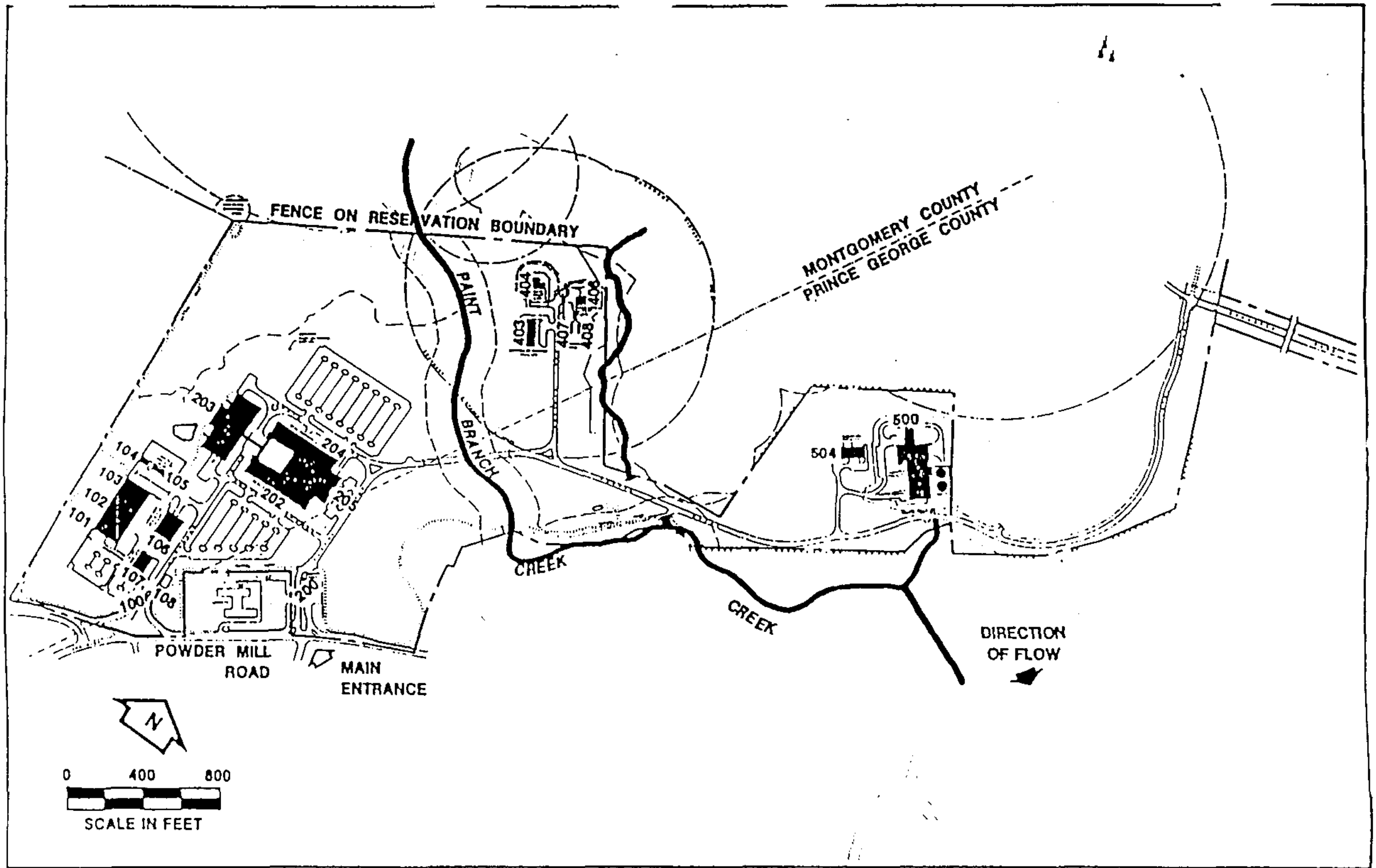
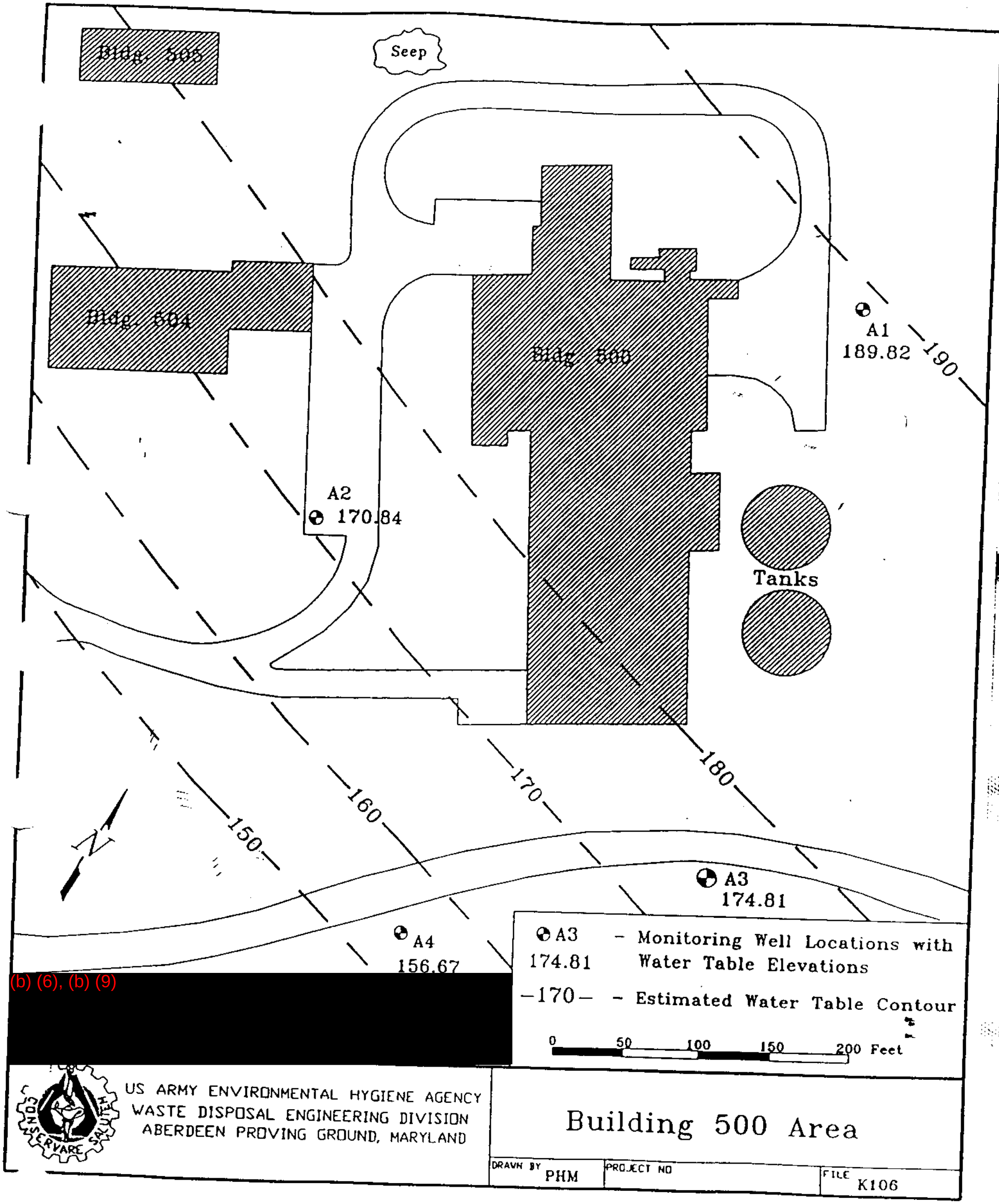


Figure 2. SSHP-2 Site Area Locator Map Adelphi Laboratory Center, Adelphi, Md.



SSHP-3 Site Area Map

2.0 ENTRY OBJECTIVES

The RI field activity will consist of soil borings advanced to the water table near the oil water separator and underground storage tanks and split spoon sampling. Groundwater wells outside Bldg. 500 will be installed along with two installed inside Bldg. 500 through the concrete floor slab. Soil- and ground-water sampling along with geophysical logging will occur at each of the installed wells. Piezometers will be installed.

Slug tests and groundwater sampling will be conducted of selected wells including existing wells. Water samples will be taken from Bldg. 500's floor drains, sump and drainage discharge point, Site W drainage swale, and from two nearby residential wells. Soil samples will be taken after hand augering in the blowdown area. The above activities will be performed to characterize the nature and extent of groundwater and surface water contamination, and soil and sediment matrices.

3.0 PROJECT MANAGEMENT

3.1 Activities

BCOE has been authorized to perform the activities described within the Work Management Plan (WMP), Field Sampling Plan (FSP), Site-Specific Safety and Health Plan (SSHP), and the Quality Assurance Project Plan (QAPP).

All field work will be performed by the Baltimore District, U.S. Army Corps of Engineers. The geotechnical drilling and sampling for the project will be performed by the Baltimore District's Field Exploration Unit, Geology and Investigations Section (BCOE-FEU).

Analytical testing will be performed by Chemron, Inc., San Antonio, Texas.

Quality assurance testing will be provided by New England Division Environmental Laboratory, U.S. Army Corps of Engineers.

3.2 Personnel

The organizational structure and responsibilities are designed to ensure adequate project control and proper quality assurance for the field program at ALC.

ALC Primary POC: Robert P. Craig, P.E., Environmental Engineer, Risk Management Division.
(301) 394-4511

ALC Alternate POC: John Feustle, Environmental Engineer, Risk Management Division.
(301) 394-4511

Key Baltimore District personnel and their responsibilities are provided below:

Project Manager CENAB-EN-PP-E	Mr. Khal Masoud (410) 962-4448
Design Manager CENAB-EN-HM	Mr. William Thayer (410) 962-6121
Project Hydrogeologist CENAB-EN-GG	Mr. James Spratt (410) 962-6641

Project Geologist CENAB-EN-GG	Ms. Michelle Brock (410) 962-6649
Project Environmental Engineer CENAB-EN-HT	Mr. Gary Schilling 410) 962-3134
Quality Assurance Officer CENAB-EN-HI	Mr. Robert Miller 410) 962-6744
Health and Safety Officer CENAB-EN-HI	Mr. Maurice Wooden 410) 962-6740
Site Safety Officer (SSO) CENAB-EN-HT	Mr. Clint Kneten (410) 962-6743 (410) 962-7680 (mobile)
Field Geologists CENAB-EN-GG	Mr. Lyle Griffith/ Mr. Andrejs Dimbirs (410) 962-4044 (410) 370-1348
Chief, Field Exploration Unit CENAB-EN-GGE	Mr. Bill Kriner (410) 962-4044
Sampling Personnel CENAB-EN-HT	Ken Hilton/Sarah Streeter/Clint Kneten (410) 962-4375/3631/6743

3.3 Responsibilities

Project Manager
- Primary liaison with ALC for project funding and schedule.
- CENAB POC for ALC Installation Restoration Program.
- Notifies ALC POC of changes that may affect the quantity or quality of generated data or costs.

Design Manager
- Liaison with ALC on technical issues.
- Tracks project costs and schedule.
- Ensures project objectives developed by ALC/CENAB are met.
- Coordinates CENAB team.
- Notifies Project Manager of field changes that may affect the quantity or quality of generated data or costs.

Project Hydrogeologist
- Responsible for coordinating all geotechnical branch activity during the project.
- Develops field investigation program that meets the project objectives.

Project Geologist
- Responsible for the preparation of the FSP, WMP, drilling instructions and RI report.
- Coordinates between geotechnical personnel in the office and field.
- Responsible for verifying that field work complies with WMP and FSP.
- Notifies Design Manager of field changes that may affect the quantity or quality of generated data or costs.

Environmental Engineer

- Responsible for coordinating all Remedial Investigation and Design (RID) section activity.
- Provides guidance in all areas related to environmental and chemical engineering.

Quality Assurance Officer

- Develops and implements the Quality Assurance Project Plan.
- Coordinates with analytical chemistry laboratories (QA and QC) and reviews laboratory reports.

Health & Safety Officer

- Prepares and coordinates health and safety plan (SSHP).
- Supplies input for specific health and safety problems which may arise during operations.
- Provides oversight of SSO activities.
- Conducts specialized training as required.

Site Safety Officer

- Enforces the SSHP.
- Ensures required safety equipment is on-site, clean and operable.
- Revises equipment requirements or procedures based on new information.
- Coordinates emergency medical response.
- Designates rescue team for supplied air operations.
- Monitors personnel exposures/stress.
- Notifies appropriate emergency personnel in event of accident, fire or explosion.
- Has the authority to cease any operations not in compliance with the SSHP, or which threatens the health or safety of on-site personnel or the general public, or may cause significant adverse impact to the environment.
- Maintains field log containing weather conditions, instrumentation calibration documentation, records of air monitoring and personnel exposure data and other information as required.

Field Geologist

- Directs drilling procedures.
- Prepares drilling logs.
- Establishes and marks site boundaries.
- Coordinates access and security on site.
- Selects the type of drilling equipment and practices to be used.
- Directs drilling procedure.
- Responsible for collecting representative field data and recordkeeping of field activities, describing samples, packaging an shipping samples.
- Notifies Chief, Field Exploration Unit of field changes that may affect the quantity or quality of generated data or costs.

Chief, Field Exploration Unit

- Responsible for coordination of field drilling activities.
- Selects qualified personnel for field team.
- Notifies Project Geologist of field changes that may affect the quantity or quality of generated data or costs.

Sampling Personnel

- Responsible for collecting representative field data and record keeping of field activities.

- Comply with the FSP and SSHP.
- Report unsafe working conditions.

4.0 TRAINING

All employees on this project have completed the hazardous waste worker training (40 hrs) which met the specific subjects outlined in 29 CFR 1926.65 (e) and have had the following additional training:

a. 3 days of actual field experience under the direct supervision of a trained experience supervisor.

b. 8-hours of refresher training, which is given annually.

All on-site supervisors have completed the above requirements and an additional 8-hour course for Management and Supervisor Training of hazardous waste operations. At least two members of the on-site personnel are currently certified in first aid and CPR. Documentation of training of Baltimore District employees is maintained in the Baltimore District office.

4.1 VISITORS

Authorized visitors will not be permitted to enter areas where they may be exposed to hazardous substances if they do not meet the training requirements summarized above and applicable safety and health requirements. All visitors will be restricted to a passive status in which they may observe activities at the site from a distance, typically 50 feet or more.

5.0 MEDICAL SURVEILLANCE

All employees working on this site have received proper medical clearance for respirator use and are enrolled in a medical surveillance program in accordance with 29 CFR 1926.65 and 29 CFR 1910.134 and are included in a medical surveillance program for hazardous waste workers. Documentation of medical clearance for Baltimore District employees is maintained in the Baltimore District's Office of Human Ressources (410) 962-6013.

6.0 SAFETY MEETINGS

The Site Safety Officer (SSO) will conduct a safety meeting at the start of each workday. Additional meetings may be conducted, as required. Meetings will include pertinent information regarding the day's work and include, but is not limited to, any of the following areas:

a. The whereabouts of any hazardous chemicals near specific work areas.

b. Methods used to detect the presence or release of hazardous chemicals at the site.

c. The physical and chemical health hazards of the hazardous chemicals at the site.

d. Protective measures such as safe work practices, emergency procedures, and personal protective equipment (PPE).

e. Details regarding the proper use of protective measures and material safety data sheets.

f. The location of the evacuation point.

g. Changes to the SSHP.

7.0 SITE CONTROL AND SECURITY

The worksite will be zoned to reduce the spread of hazardous substances to clean areas. An Exclusion Zone (EZ) will be established with a radius of 50 feet, when feasible, around the drilling operations and other areas of intrusive activities. No unauthorized person will be allowed within the EZ, nor will any authorized person remain unnecessarily in this zone. This zone will be delineated by yellow caution tape. Since this area has the highest potential for exposure to hazardous chemicals, the proper PPE must be worn in this area.

The Contamination Reduction Zone (CRZ) will be located just outside the EZ and delineated with yellow caution tape. Personnel in this area will be required to wear PPE which is one level less than that worn in the EZ. During intrusive field activities, the exact layout will depend on the wind direction the day of work and site conditions. The CRZ will have only one accessible point to the EZ.

The on site Support Zone (SZ) will be located upwind of the exclusion zone. The command post and staging area will be located inside this zone. No specific PPE requirements are needed in this area.

Site access will be denied to the general public by the Site Security Officer and the caution barriers. All equipment and materials will be secured during non-work hours.
Boreholes will not be left open when unattended.

8.0 HAZARD EVALUATION

8.1 Overview

Environmental investigations in the spring and fall of 1994 revealed the elevated presence of trichloroethene (TCE), dichloroemethane, thallium, and nickel in groundwater monitoring well samples upgradient and downgradient of building 500. Stream surface water samples for Royal Demolition Explosive (RDX) indicated that the material was present in elevated levels. Sediment samples in the same stream revealed the presence of total petroleum hydrocarbons.

It should be recognized that knowledge of physical, biological or chemical hazards which might be encountered or concentrations of contaminants that might be found can only be assumed based on a review of available site information and recommendations. Chemical constituents believed to be at the site and potential physical exposure hazards which may be present during site activities are discussed in this section. Project activities may involve potential exposure to toxic or hazardous substances. Overall, the hazards associated with the presence of anticipated chemicals are expected to be minimal. However, the maintenance of good health, and the provision for the safety of on-site personnel, should be regarded at all times during the performance of field activities.

8.2 Chemical Exposure

The potential chemicals of concern (COC) at the Bldg. 500 area site are Volatile Organic Compounds (VOCs) such as trichloroethene, dichloromethane and BTEX (benzene, toluene, ethyl benzene, xylene), solid materials such as inorganic nickel, thallium and silica. Silica could be a potential contaminant during the indoor well drilling operations. Another one of the COC is the high explosive compound, RDX. The explosive potential of RDX for this project is discussed in Section 11.5.

Protective measures taken to mitigate exposure will also provide adequate and appropriate protection against known chemical contaminants detected on site. If the recommended PPE is used properly according to this plan, and Standard Operating Procedures (SOP) and decontamination procedures followed, unhealthful exposures should not occur.

8.3 Chemical Hazards

Trichloroethene
Synonyms: Trichloroethylene, Ethylene and Acetylene Trichloride, Trilene, TCE
CAS: 79-01-6
OSHA PEL: 100 ppm, 200 ppm (ceiling)
NIOSH REL 25 ppm
ACGIH TLV: 50 ppm, 100 ppm (STEL)
IDLH: 1000 ppm
Flash point: 90°F
Vapor pressure: 58 mm Hg
Ionization potential: 9.45 eV
Physical qualities: colorless liquid with sweet odor like chloroform
Acute symptoms of exposure: eye and skin irritation with fatique,nausea, headaches and confusion, causing visual difficulty and skin numbness.
Chronic symptoms of exposure: skin dryness and dermatitis, cough, double vision, impaired coordination, anxiety, slowness of heartbeat and intolerance to alcohol.

Dichloromethane
Synonyms: Methylene Chloride, Methylene Dichloride,
CAS: 75-09-2
OSHA PEL: 500 ppm, 1000 ppm (ceiling)
ACGIH TLV: 50 ppm
IDLH: 2300 ppm
Flash point: not applicable (NA)
Vapor pressure: 350 mm Hg
Ionization potential: 11.32 eV
Physical qualities: colorless liquid with sweet odor like chloroform
Acute symptoms of exposure: anesthetic effects with light-headedness,mental confusion, headache,nausea and vomiting, skin and eye irritation.
Chronic symptoms of exposure: irritation to the skin, central nervous system effects and cardiovascular system effects.

Thallium
Synonyms: Thallium sulfate, Thallium acetate, Thallium nitrate
CAS: 7440-28-0
OSHA PEL: 0.1 mg/m^3 with skin designation
ACGIH TLV: 0.1 mg/m^3
IDLH: 15.0 mg/m^3
Flash Point: NA
Vapor Pressure: 0 mm Hg (approx)
Ionization Potential: NA
Physical Qualities: colorless, odorless solid
Acute symptoms of exposure: ingestion may cause nausea, vomiting, diarrhea, abdominal pain, bleeding from the gut, drooping eyelids, crossed eyes, weakness.
Chronic symptoms of exposure: cumulative intoxication with hair falling out, rapid heartbeat, visual difficulties, trembling, mental abnormalities

Nickel
Synonyms: Nickel Metal, Nickel Catalyst

CAS: 7440-02-0
OSHA PEL: 1.0 mg/m^3
NIOSH REL. 0.015 mg/m^3
ACGIH TLV: 1.0 mg/m^3
IDLH: 10.0 mg/m^3
Flash point: NA
Vapor Pressure: 0 mm Hg (approx)
Ionization potential: NA
Physical qualities: silvery gray, metallic, odorless powder
Acute symptoms of exposure: headache, dizziness, shortness of breath, vomiting, blue color of the skin, fever-like symptoms, allergic skin rash.
Chronic symptoms of exposure: cancer of lungs and sinuses.

Toluene
Synonyms: methyl benzene, methyl benzol, phenyl methane, toluol
CAS: 108-88-3
OSHA PEL: 100 ppm
ACGIH TLV: 50 ppm
IDLH: 2000 ppm
Flash point: 40°F
Vapor pressure: 20 mm Hg
Ionization potential: 8.82 eV
Physical qualities: organic liquid with sweet, pungent, benzene-like odor
Acute symptoms of exposure: eye, skin and respiratory irritation with fatique, headaches and confusion, causing visual difficulty in bright light, and skin numbness.
Chronic symptoms of exposure: skin dryness and dermatitis and liver, kidney and central nervous system damage.

Ethylbenzene
Synonyms: ethylbenzol, phenylethane
CAS: 100-41-4
OSHA PEL: 100 ppm
ACGIH TLV: 100 ppm, STEL 125 ppm
IDLH: 2000 ppm
Flash point: 55°F
Vapor Pressure: 10 mm Hg
Ionization potential: 8.76 eV
Physical qualities: organic liquid with aromatic odor
Acute symptoms of exposure: eye, skin and respiratory irritation with a narcosis effect.
Chronic symptoms of exposure: dermatitis and central nervous system disorder.

Xylene (ortho-, meta-, para- isomers)
Synonyms: ortho: 1, 2-Dimethylbenzene, o-Xylol; meta: 1, 3-Dimethylbenzene, m-Xylol; para: 1, 4-Dimethylbenzene, p-Xylol
CAS: 1330-20-7
OSHA PEL: 100 ppm
ACGIH TLV: 100 ppm, STEL 150 ppm
IDLH: 1000 ppm
Flash Point: ortho: 63°F; meta: 84°F; para: 81°F
Vapor Pressure: ortho: 7 mm Hg; meta: 9 mm Hg; para: 9 mm Hg;
Ionization Potential: ortho: 8.56 eV; meta: 8.56 eV; para: 8.44 eV
Physical qualities: organic liquid with aromatic odor
Acute symptoms of exposure: eyes, nose and throat irritation with dizziness, excitement, loss of appetite, nausea, vomiting, abdominal pain and staggering gait
Chronic symptoms of exposure: liver, kidney and eye damage and dermatitis

Benzene
Synonyms: benzol, phenyl hydride, benzolene, carbon oil, coal naphtha
CAS: 71-43-2
OSHA PEL: 1.0 ppm, STEL 5.0 ppm
ACGIH TLV: 10 ppm
IDLH: 3000 ppm
Flash Point: 12 °F
Vapor Pressure: 75 mm Hg
Ionization Potential: 9.24 eV
Physical Qualities: light yellow liquid with pleasant, sweet aromatic odor
Acute symptoms of exposure: dizziness, giddiness, headache, respiratory and gastrointestinal irritation, weakness, skin and mucous membrane irritation
Chronic symptoms of exposure: nervousness, irritability, blurred vison, labored breathing, dermatitis, blood disorders such as aplastic anemia and leukemia

RDX
Synonyms: Royal Demolition Explosive, Cyclonite, Cyclotrimethylenetrinitramine
CAS: 121-82-4
OSHA PEL: NA
NIOSH REL: 1.5 mg/m^3, 3.0 mg/m^3 (STEL) with skin designation
ACGIH TLV: 1.5 mg/m^3, with skin designation
IDLH: not determined
Flash Point: explodes
Vapor Pressure: 0.0004 mm Hg (approx)
Ionization Potential: NA
Physical qualities: white, crystalline powder that is a powerful explosive
Acute symptoms of exposure: headache, irritability, fatique, weakness, tremors, nausea, dizziness, vomiting, insomnia, seizures.
Chronic symptoms of exposure: skin sensitization can cause itching and development of skin rash and hives.

Silica
Synonyms: Quartz, Cristobalite, Tridymite, Fused Silica, Tripoli
CAS: 14808-60-7
OSHA PEL: 0.1 mg/m^3 (1989 vacated PEL)
NIOSH REL: 0.05 mg/m^3
ACGIH TLV: suspected human carcinogen (keep exposures to the minimum)
IDLH: 25.0 mg/m^3
Flash Point: NA
Vapor Pressure: 0 mm Hg (approx)
Ionization Potential: NA
Physical qualities: colorless, odorless solid as a component of many mineral dusts
Acute symptoms of exposure: cough and shortness of breath, eye irritations.
Chronic symptoms of exposure: scarring of lungs, progressive respiratory symptoms (silicosis).

* The NIOSH RELs are listed when their values are more stringent than the PEL or TLV.

8.4 Physical Hazards

Tasks required for activities associated with this project may involve exposure to slipping, falling, heat/cold stress, noise, and other physical hazards associated with intrusive activities which generate airborne particulates/release toxic vapors into the breathing zone of the workers. Skin absorption may occur from contaminated soils directly and from airborne contaminants.

8.5 Biological Hazards

Potential biological danger associated with this site are those which would be encountered working outside. Employees should exercise caution when encountering hazardous plants (poison ivy), animals and insects (snakes, spiders, bees, wasps, ticks, mosquitoes, ants, etc.) at the worksite. Field personnel should wear adequate clothing to deny access to the skin and should examine themselves carefully everyday for the presence of ticks. Employees who are known to be highly sensitive to insect stings should carry a "sting kit" and notify the SSO at the worksite.

8.6 Overall Hazard Evaluation

[ ] High [ ] Medium [x] Low [ ] Unknown

8.7 Activities Of Greatest Concern

All intrusive activities which generate airborne particulates/release toxic vapors into the breathing zone of the workers. Skin absorption may occur from contaminated soils directly and from airborne contaminants. Caution should be observed to avert drilling into buried utilities and contacting overhead powerlines.

9.0 HAZARD CONTROL

Work shall comply with all Federal, State, and local health and safety requirements including; OSHA 29 CFR 1904, 1910 and 1926, EPA 40 CFR 260-270, USACE EM 385-1-1, and all District safety directives and policies.

All instrusive activity sites will be inspected for health and safety hazards by the Site Safety Officer (SSO) prior to entering the site for the instrusive activity. The SSO will then take all corrective measures necessary to safely work at the site. This inspection and all corrective measures will be documented and communicated to all site workers at the initial safety meeting and subsequent safety meetings held.

9.1 Standard Operating Procedures

a. No eating or drinking is permitted within the contamination reduction zone (CRZ) or the exclusion zone (EZ). An exception is made for the replacement of fluids as a preventive measure for heat stress, however hands and face must be washed with potable water prior to drinking replacement fluids.

b. No tobacco use is permitted within the EZ or CRZ.

c. No beards or facial hair is allowed on site that may interfere with the seal of a negative pressure respirator.

d. No contact lenses will be worn on site in the EZ or CRZ.

e. Contamination avoidance shall be practiced to include: not walking through puddles or mud unnecessarily, avoiding kneeling on ground or leaning on equipment whenever possible. Weather conditions that may escalate potential site hazards such as lightning, rain or extreme temperatures will be logged.

f. Wood planking and weighted plastic coverings will be placed over any drill hole that will remain open overnight.

g. If evidence of illegal dumping or other suspicious fill is encountered outside the project area, work at the location will stop. The area will be designated an Exclusion Zone and encircled with caution tape. The SSO will be notified immediately.

h. Noise-Hearing protection devices will be worn by all field personnel in work areas where noise levels are at or above 85 dBA. These areas include: within ten feet of the drill rig motor, within ten feet of the rear of the drill rig when the cat head is turning and the hammer is pounding, within ten feet of the drill rig when the auger is turning, and indoor drilling. The wearing of hearing devices is a condition of employment.

i. Employees will use extreme caution in inclined areas of the worksite. Ground surfaces may be wet, slippery and have hazardous objects protruding from the surface.

j. Employees should exercise caution when encountering hazardous plants (poison ivy) and animals (snakes, spiders, bees, wasps, ticks, mosquitoes, ants, etc.) at the worksite. Employees who are known to be highly sensitive to insect stings should carry a "sting kit" and notify the SSO at the worksite. All employees are encouraged to use permethrin (0.50%) clothing repellent and DEET (30%) skin repellent for protection against ticks and mosquitoes. Skin repellent will not be used by sampling personnel.

k. Electrical - All underground and overhead power lines will be located and noted by the SSO. Surface areas above underground utilities will be marked. Equipment will be grounded and operating procedures will be in accordance with EM 385-1-1, Section 11.C.

l. Employees will exercise extreme caution in the vicinity of open excavations. Under no circumstances will employees enter excavations or other confined spaces.

m. Thermal stress - All personnel will be assigned a "buddy" who will observe the employee for signs of thermal stress, although personnel should be alert for heat or cold related injuries. The signs and symptoms of thermal stress are included in Appendix C. In addition, work/rest regimes, as outlined in the attachment, in accordance with the ACGIH guidelines will be established by the SSO when necessary. Water, Gatorade (or similar electrolyte liquid) will be available on site.

n. Fire - No heaters or open flames will be allowed in any exclusion zone. If a heater is to be used, it will be a construction type (i.e. salamander). Flammable liquids will be stored in appropriate containers.

10.0 PERSONAL PROTECTIVE EQUIPMENT

A personal protective equipment (PPE) program in accordance with 29 CFR 1926.65 (g) (5) and 29 CFR 1910.134 will be implemented. The level of protection to be implemented at the worksite was determined based on the type of chemicals suspected to be present, chemical toxicity characteristics and potential routes of worker exposure. The use of appropriate personal protective equipment, in conjunction with site entry and safety decontamination procedures will reduce the potential for worker contact with hazardous substances present at the site. It should be noted that the use of PPE can itself create hazards such as heat stress, impaired vision and mobility, and communication difficulties. Equipment and clothing selected will provide an adequate level of protection, but avoid, to the maximum extent practical, potentially adverse affects that can result from overprotection.

Levels of PPE will be used/worn as described by this plan are indicated in the following section. No downward changes to the level of protection as specified in this plan will be allowed without the approval of the Site Safety Officer. Appendix A states the specific equipment requirements of the designated Levels of Protection.

Description of Tasks: soil borings and split spoon sampling

The field team will perform the above operations either with hand augering or hammering or use of a drill rig

[x] Intrusive [ ] Non-intrusive

Level of Protection

[ ] A [ ] B [ ] C [x] Mod-D [ ] D

Description of Tasks: monitoring well installations and sampling of groundwater and soil along with geophysical logging

The field team will install eight monitoring wells and two piezometers of approximately 40 feet depths. Two the wells will be installed inside Bldg. 500 through the concrete floor. The SSO will collect the samples for eventual testing of volatile organic compounds, selected solids and other chemical groups.

[x] Intrusive [ ] Non-intrusive

Level of Protection

[ ] A [ ] B [ ] C [x] Mod-D [ ] D

Description of Tasks: surface water, soil and sediment, floor drains and sump, and residential well sampling

The SSO will collect samples from predetermined locations for eventual testing of halogenated volatiles and selected solids.

[x] Instrusive [ ] Non-intrusive

Level of Protection

[ ] A [ ] B [ ] C [x] Mod-D [ ] D

11.0 MONITORING

11.1 Chemical Contaminants

Monitoring will be conducted by the Site Safety Officer continuously during all the intrusive tasks listed in Section 10.0. Exposure monitoring will be conducted for the VOCs using a photoionization detector (PID) with a preferred 11.4 or higher eV bulb. The worker's breathing zone near the intrusive activities will be checked with the PID. Also, the opening to the borehole will be checked with the PID each time the auger is removed. Any groundwater removed from the boreholes will be also monitored as soon as it contacts the atmosphere.

At any time when concentrations measured with the PID in the breathing zone exceed 4.0 ppm, direct read sampling for benzene will conmence using benzene colorimetric tubes.
If the results of colorimetric tube sampling indicate a benzene concentration at or greater than 1.0 ppm and levels have not dissipated in 30 minutes, then work activities will cease in the exclusion zone and the field team will move to an area where normal levels are indicated. Level B PPE will be worn by the workers and the work will resume. See Appendix A for specific requirements of Level B PPE. The Health and Safety Officer and Design Manager will be contacted

If benzene colorimetric tube results remain less than 1.0 ppm, then work in the exclusion zone can continue until a PID reading of 20.0 ppm is reached in the workers' breathing zone. When this occurs, direct read sampling for TCE will commence using TCE colorimetric tubes. If the results of colorimetric tube sampling indicate a TCE concentration at or greater than 25.0 ppm in the breathing zone and levels have not dissipated in 30 minutes, then work activities will cease in the exclusion zone and the field team will move to an area where normal levels are indicated. Level B PPE will be worn by the workers and the work will resume. The Health and Safety Officer and Design Manager will be contacted.

If TCE colorimetric tube results remain less than 25.0 ppm, then work in the exclusion zone can continue until a PID reading of 40 ppm is reached in the workers' breathing zone. When this occurs, direct read sampling for dichloromethane (DCM) will commence using DCM colorimetric tubes. If the results of colorimetric tube sampling indicate a DCM concentration at or greater than 50.0 ppm in the breathing zone and levels have not dissipated in 30 minutes, then work activities will cease in the exclusion zone and the field team will move to an area where normal levels are indicated. Level B PPE will be worn by the workers and the work will resume. The Health and Safety Officer and Design Manager will be contacted.

If DCM colorimetric tube results remain less than 50.0 ppm, then work in the exclusion zone can continue until a PID reading of 50.0 ppm is reached in the workers' breathing zone. When this occurs, work in the exclusion zone will cease and those employees will move to an area where normal levels are indicated. Level B PPE will be worn by the workers and the work will resume. A single spike on the PID should not stop work, but a sustained reading (longer than ten seconds) or repetitive spikes (5 within 10 minutes) shall stop work. Detection of unusual odors shall not stop work. (See emergency procedures for further instructions) Work shall resume after adequate upgrade of PPE is accomplished. Highest levels of PPE shall remain donned until additional monitoring indicates that a lower level of PPE is allowed.

Notations of momentary spikes, high readings, and actions taken will be recorded on the borings logs and in the intrusive activities logbook. All instruments will be calibrated daily according to the manufacturers instructions and recorded in the logbook.

Prior to performing field activities in dry, dusty areas where contaminated soils are likely to be encountered, workers will wet down the area of activity with water in order to decrease dust generation. If the wetting process is expected to result in potentially contaminated runoff, measures will be taken to contain the runoff. In the event that dust suppression measures are not possible, workers in such areas will wear Level C protection including air purifying respirators with combination organic vapor/HEPA cartridges.

The particulate chemical hazards of nickel and thallium have been detected in either ground or surface water. With water sampling of these materials and the generation of water during well installation, the potential exposure to airborne particulates of these compounds at or greater than their action levels is estimated to be very remote.

The potential for silica and other respirable dust exposure exist when the indoor well installation operations cut through the approximately two feet thick concrete floor. At any time during the concrete drilling operation that visibly generated dust is observed to linger in the breathing zone, workers in such areas will wear Level C protection including air purifying respirators with combination organic vapor/HEPA cartridges. Monitoring Action Levels for chemical contaminants, explosion/fire, noise and temperature are shown in Table SSHP-1.

11.2 Noise

The majority of the machinery and heavy equipment used in hazardous waste site operations generate noise levels in excess of the OSHA PEL. A hearing protection program will be instituted if either continuous or impact noise levels exceed 85 dBA (slow response) for an 8-hour work shift, in accordance with 29 CFR 1910 and 1926. If unable to carry on conversation at an arm length, or at 3 ft. distance, hearing protection measures should be instituted. The SSO will use a Type II Noise Level Meter to monitor worker exposures. Hearing protection, such as ear plugs and muffs, or administrative controls will be used if engineering controls are not feasible.

11.3 Temperatures

Heat stress monitoring of employees will be conducted when employees are wearing impermeable clothing and the ambient shaded dry bulb temperature is 70 °F or higher. Weather conditions will be monitored by the SSO. All monitoring data will be recorded in the logbook. Heat stress monitoring procedures are stated in section (1)(f) of Appendix C.

11.4 Fire and Explosion

Whenever identified materials are characterized as being a flammable, such as TCE, the potential exist that fire and explosion could occur. Areas of intrusive activities will be monitored for combustible gas using a combustible gas/oxygen level indicator (CGI/O_2 Meter).

11.5 Ordnance and Explosive Waste (OEW)

1994 water samples revealed the presence of the high explosive compound, RDX. RDX is normally a booster explosive which means it is the third step in a basic explosive train of a primer, detonator and bursting charge. The explosiveness of the compound for this project is considered to be nil when the following factors are considered: its water bound location, surface water sampling intrusion only, no upstream or upgradient surface intrusion (drilling), and absence of the mentioned ingredients train for detonation.

However, this does not preclude the possibility that some unexploded ordnance (UXO) may exist at the site. If suspect materials are uncovered during site investigations, the field team should mark the area and immediately evacuate the immediate area and contact the Health and Safety Officer and the Design Manager. In no circumstances are the field team members to touch or approach within five feet (5 ft.) of potential OEW.

11.6 Radiation and Confined Space

Based on a review of the scope of services for this project, the site history, interviews with ALC personnel and a visit to the site, the hazards associated with exposure to ionizing and non-ionizing radiation and confined space entry are not anticipated as part of the field activities.

Table SSHP-1 Monitoring Action Levels

INSTRUMENT	LOCATION	ACTION LEVEL	ACTION
PID	Borehole /dipping / sampling device	Reading above background	Move instrument to breathing zone; compare results
	Breathing zone	4.0 ppm or higher as a sustained[1] reading	Continue work with benzene colorimetric tube monitoring begun. With benzene readings at or greater than 1.0 ppm in breathing zone, depart Exclusion Zone. If levels have not dissipated in 30 minutes, Continue work in Level B PPE.
		20ppm or higher as a sustained[1] reading	Continue work with TCE colorimetric tube monitoring. With TCE readings at or greater than 25.0 ppm, continue work in Level B PPE.
		40 ppm or higher sustained[1] reading	Continue work with DCM colorimetric tube monitoring. With DCM readings at or greater than 50.0 ppm, continue work in Level B PPE.
		50 ppm or higher	Continue work in Level B PPE
CGI/O_2	Borehole/dipping / sampling device	< 10% of Lower Explosive Limit	No action required. Proceed with caution in areas that may contain combustible gas.
		10%-20% of LEL	Monitor work area to identify cause, perform continous CGI monitoring, remove ignition sources.
		> 20% of LEL	Evacuate work area and contact H&S Officer
Noise Meter	Employee hearing zone	(With hearing protection of minimum NRR 20 dB): continuous 85 dBA or higher,	Modify PPE, consult Health and Safety Officer
Environmental stress	Entire worksite	Any elevated stress condition[2]	Apply preventive measures, as required
Weather conditions	Entire worksite	Lightning within 10 statute miles	Cease work, move employees to safe area, wait for change in weather

ACTION LEVEL - The action levels for the PID are based on measurements taken above background concentrations when the background concentration is less than 1 ppm. When background concentrations exceed 1 ppm total votatile hydrocarbons, PID action levels will be inclusive of background concentrations and so noted in the logbook.

[1] A sustained reading on the PID is a reading (longer than 10 seconds) or repetitive spikes (5 spikes within 10 minutes).
[2] As outlined in Attachment C (Environmental Stress).

12.0 COMMUNICATION PROCEDURES

a. Personnel will be informed of all known site hazards during an initial safety meeting and will be kept informed of hazards discovered during the site investigation.

b. Personnel in the Exclusion Zone will remain in constant communication or within sight of the Support Zone personnel. Failure of communication requires evacuation of the Exclusion Zone until communication is reestablished.

c. A mobile (cellular) telephone will be on-site whenever intrusive work is performed in the project area. The phone number is (410) 591-7680 or (410) 370-1348.

d. When the emergency signal is sounded, all personnel will depart the Exclusion Zone. Personnel will relocate to the decontamination area for personnel accountability. An emergency signal is considered an emergency signal for the Exclusion Zone and the project area.

e. The emergency signal will be one of the following:

   (1) Any blast from a pressurized air horn.
   (2) Verbal notification.

f. The following standard hand signals will be used:

   (1) Hand gripping throat -- Out of air and cannot breathe.
   (2) Grip buddy's wrist -- Leave area immediately.
   (3) Both hands on buddy's waist -- Leave area immediately.
   (4) Hands on top of head -- Need assistance.
   (5) Thumb down -- No / negative.
   (6) Thumb up -- Yes / I'm OK / I am all right.

13.0 DECONTAMINATION PROCEDURES

Personnel and equipment leaving the exclusion zone shall be thoroughly decontaminated. Decontamination fluids will be permitted to infiltrate the soils surrounding the borings. The contaminated PPE will be bagged and disposed of as ordinary refuse. The following decontamination equipment is required:

4 tubs, detergent, 4 brushes, disposal bags, drop cloths for drying, garbage bags

Decontamination will be necessary any time an employee leaves the exclusion zone. For Level D, a minimum of washing outer boots and gloves with a brush in a tub of detergent and water, rinsing in clear water, removal of these items, removal of the coveralls and inner gloves, discarding them is required. (See Appendix B - Decontamination Procedures)

14.0 HAZARD COMMUNICATION

Pursuant to OSHA, 29 CFR 1926.59, Material Safety Data Sheets (MSDS) along with a list for those materials covered by the MSDS will be available for all hazardous substances brought on site. Personnel will also be briefed by the SSO regarding hazardous chemicals present at the worksite prior to starting work that personnel could be exposed to.

15.0 EMERGENCY PROCEDURES

15.1 Emergency Procedures

a. Buddy System. A buddy system will be in effect in the Exclusion Zone (EZ) at all times. (See Figure SSHP-B1.)

b. Personal Injury in the EZ. If an employee is injured while in the EZ, the employee and his buddy will exit the EZ and proceed through the Primary Decontamination Area (PDA). An employee qualified in first aid/CPR will evaluate the nature of the injury and the integrity of the PPE and determine the need for first aid, evacuation and replacement of PPE. The SSO will be immediately notified of the incident. If additional aid is required, the employee and his buddy will proceed through the Secondary Decontamination Area (SDA) as required.

c. Personal Injury in the Contaminant Reduction Zone (CRZ). If an employee is injured while in the CRZ, an employee qualified in first aid/CPR will evaluate the nature of the injury and determine the need for first aid and evacuation. The employee and his buddy will exit the CRZ, as required, proceeding through the Secondary Decontamination Area (SDA) if necessary. The SSO will be immediately notified of the incident.

d. Personal Injury in the Support Zone. If an employee is injured while in the Support Zone (SZ), an employee qualified in first aid/CPR will evaluate the nature of the injury and determine the need for first aid and evacuation. The SSO will be immediately notified of the incident.

e. Fire/Explosion. In the event of fire and/or explosion, the emergency signal will be sounded (see Section 12.0.e). All personnel will depart the EZ and move to the SDA for personnel accountability. The SSO will take appropriate action, such as controlling the spread of a small fire, summoning outside assistance or evacuating personnel to another location. For the proper operation of a fire extinguisher, the OSHA guidelines in 29 CFR 1926.150 (a) and the USACE Health and Safety Requirements from EM 385-1-1 (Section 09.E.) will be followed.

f. PPE failure. If an employee experiences a failure or alteration of PPE, the employee and his buddy shall stop work and exit the EZ. Reentry shall not be permitted until the PPE has been repaired or replaced.

g. Other Equipment Failure. If any other equipment on site fails to operate properly, the SSO and Project Team Leader shall be notified to make a determination of the effect this failure will have on operations.

h. In all situations, when an on-site emergency results in evacuation of the Exclusion Zone, personnel shall not re-enter until:

(1) The condition resulting in the emergency has been corrected;

(2) The hazards have been re-assessed;

(3) The safety plan has been revised and approval by all the initial concurring officers and

(4) site personnel have been briefed on any changes in the safety plan.

15.2 Emergency Telephone Numbers

Names and phone numbers of all emergency response personnel (ambulance, physician, hospital, fire and police) and a map showing the route to the hospital will be conspicuously posted at the work site. All field personnel will be briefed concerning the people and equipment which will be summoned during an emergency and their responsibilities during an emergency situation requiring hospitalization. Emergency contacts and telephone numbers are provided below.

- Hospital (301) 754-7000
- Police (301) 394-1117 or 911
- Fire Department (301) 394-1117 or 911
- Ambulance (301) 394-1117 or 911
- Poison Control Center (800) 962-1253
- Environmental Response Teams (410) 333-2950 or (410) 974-3551
  (MD Department of the Environment)

15.3 Emergency Medical Care

The SSO will summon emergency medical care as required. A map to Holy Cross Hospital (shown in Figure SSHP-4) will be posted conspicuously at the work site showing the location of the hospital and indicating the best route to the hospital. The hospital address is 1500 Forest Glen Road, Silver Spring, Maryland. The hospital is located approximately 4.4 miles from the site. Written directions to the hospital are as follows:

Holy Cross Hospital, Silver Spring, Maryland

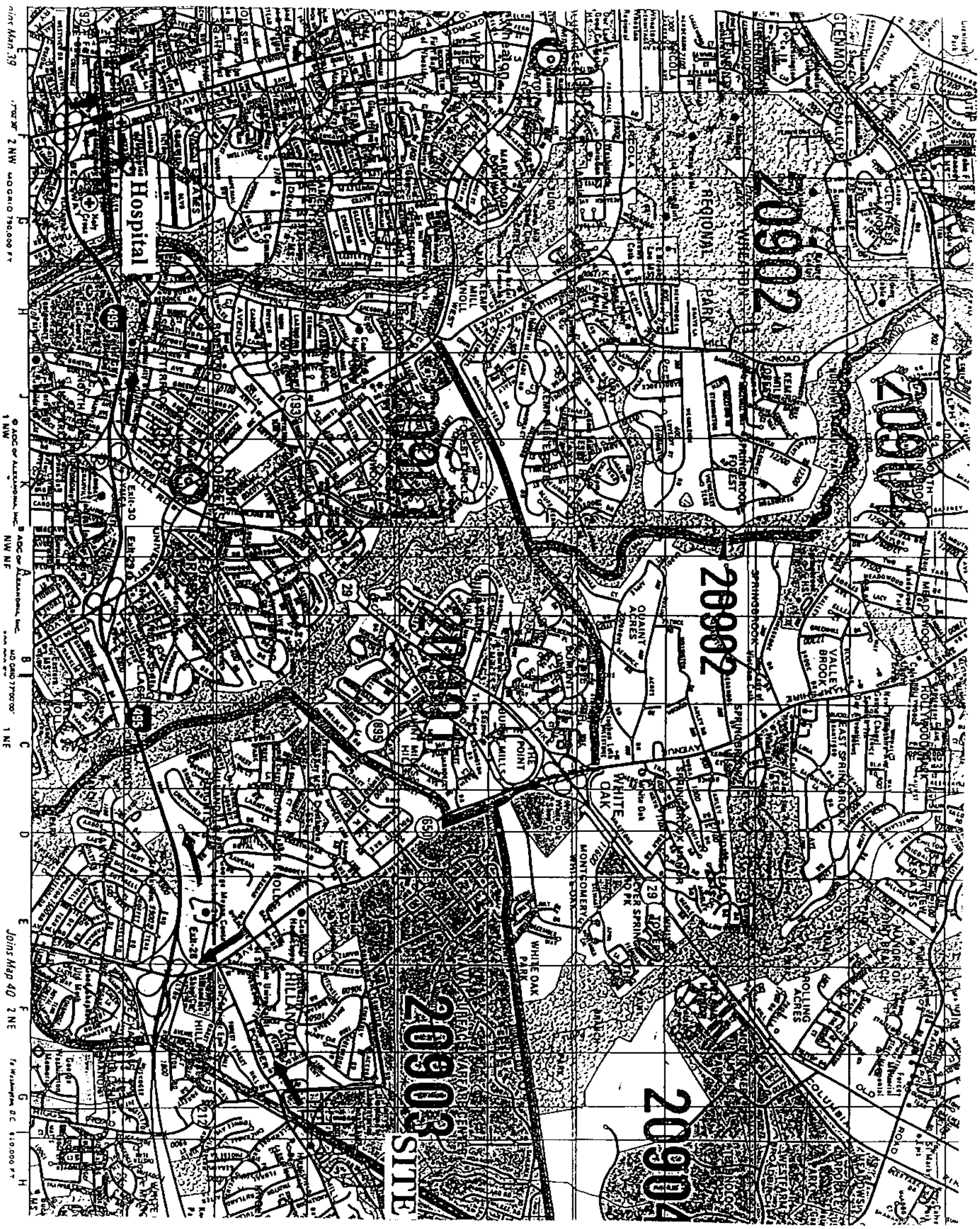
Exiting through ALC's main gate, make a right turn onto Powder Mill Road (MD Route 212). At the intersection with New Hampshire Avenue (MD Route 650), make a left hand turn onto New Hampshire Ave. Directly after the turn, prepare to make the right lane entrance turn into Interstate 495 West. Proceed on the I-495 West until Exit 31. The hospital will be passed on the right on the way to Exit 31. Depart I-495 at Exit 31 onto Georgia Avenue north (MD Route 97 North). Make the next right turn onto Forest Glen Road. Proceed until the hospital is seen on the right hand side of the road.

15.4 Emergency Reporting

The Baltimore District Safety Office shall be notified of any incident at (410) 962-4100 and the SSO shall submit the necessary forms in accordance with EM 385-1-1.

SSHP-4 **Location of Holy Cross Hospital**

SSHP-4 Location of Holy Cross Hospital



16.0 STATEMENT OF UNDERSTANDING

SITE HEALTH AND SAFETY PLAN

Remedial Investigation
Building 500
Adelphi Laboratory Center
Adelphi, Maryland

All site personnel have read the above plan and are familiar with its provisions. My signature below certifies that I have read, understand and will comply with the guidelines set forth.

Name	Signature	Date
Site Safety Officer (SSO):		
Other Site Personnel:		

APPENDIX A

LEVELS OF PROTECTION

Personal Protective Equipment - Levels of Protection

1. **Level B**

Positive-pressure, full-facepiece SCBA or positive-pressure, supplied-air respirator, with escape SCBA approved by NIOSH/MSHA
Inner (latex/nitrile) and outer chemical-resistant gloves (Viton)
Disposable hooded chemical-resistant coveralls (Saranex)
Chemical resistant boots with steel toe and shank
Hard hat and optional long underwear, cooler vest and inner coveralls

2. **Level C**

Hard hat, as required
Steel toe boots
Chemical-resistant outer boots, (nitrile)
Outer chemical-resistant gloves, (Viton)
Chemical-resistant inner (latex/nitrile) gloves
Hooded chemical-resistant clothing such as disposable coveralls (Tyvek)
Hearing protection, as required
Full-face, air purifying respirator with (NIOSH approved) combination organic vapor/HEPA filtered cartridges (GMC-H)
Optional: chemical splash gear

3. **Level D Modified**

Safety glasses and same as **Level C** above, except no respiratory protection required

4. **Level D**

Hard hat, as required
Steel toe boots/shoes
coveralls
Chemical splash gear: rubber gloves, goggles, rubber boots, and rainsuit or apron (as required)

Table SSHP-A1 Personal Protective Equipment Requirements

PPE	A	B	C	Mod-D	D
Protective headgear (hardhat), as required	X	X	X	X	X
Hearing protection (minimum NRR 20 dB) (as required)	X	X	X	X	X
Safety glasses, as required				X	X
Overgarment					
Impermeable, encapsulating	X				
Impermeable, non-encapsulating (e.g. Saranex)		X	X[1]	X[1]	
Permeable, chemical resistant (e.g. Tyvek)			X[2]	X[2]	
Permeable, non-chemical resistant (e.g. cotton)					X
Apron, impermeable (e.g. Saranex)	X[3]	X[3]	X[3]	X[3]	
Supplied air (e.g. SCBA[4]; airline with EEBA[5])	X	X			
Full-face air-purifying respirator (combination organic vapor/HEPA filtered cartridges)			X		
Inner gloves (latex)	X	X	X	X	
Outer gloves (Viton or SilverShield)	X	X	X	X	
Footwear, with steel toe and shank	X	X	X	X	X
Footwear, outer, chemical resistant	X	X	X	X	
Splash-proof safety goggles				X[6]	
Face Shield (8 inch minimum length)				X[6]	

[1] For tasks involving splash or possible spills.
[2] For tasks not involving splash or possible spills.
[3] Driller and helpers will wear Saranex apron in addition to Saranex overgarment during tasks likely to result in gross contamination of the overgarment.
[4] Self-contained breathing apparatus.
[5] Emergency escape breathing apparatus.
[6] For surface water sampling for RDX

APPENDIX B

DECONTAMINATION PROCEDURES

1. All personnel and equipment leaving the Exclusion Zone shall be thoroughly decontaminated. As a minimum, hands and face will be washed with potable water whenever leaving the Exclusion Zone (EZ) for any reason. See Figure SSHP-B1 (Typical Layout of Decontamination Facilities).

2. **Personnel Decontamination Procedures**

a. All personnel who have entered the EZ will perform personal decontamination in a primary decontamination area (PDA) located immediately outside the EZ. PDA will include boot/glove wash basins, emergency eyewash and container for disposable PPE items.

b. All personnel who have entered the EZ will perform personal decontamination in the secondary decontamination area (SDA) prior to departing the CRZ.

c. All personnel who have entered the CRZ, but who have not entered an EZ, will ensure that external PPE/garments have been adequately decontaminated prior to departing the CRZ. SDA will have boot/glove wash basins and container for disposable PPE items.

3. **Equipment Decontamination Procedures**

a. Major equipment (e.g. drill rig, trailers, augers, etc.) will be steam cleaned before departing the CRZ.

b. Sampling equipment (e.g. split spoons, stainless steel pans, etc.) will be steam cleaned prior to departing the CRZ.

c. Other equipment (e.g. monitoring instruments, logbooks, etc.) will be cleaned as directed by the SSO.

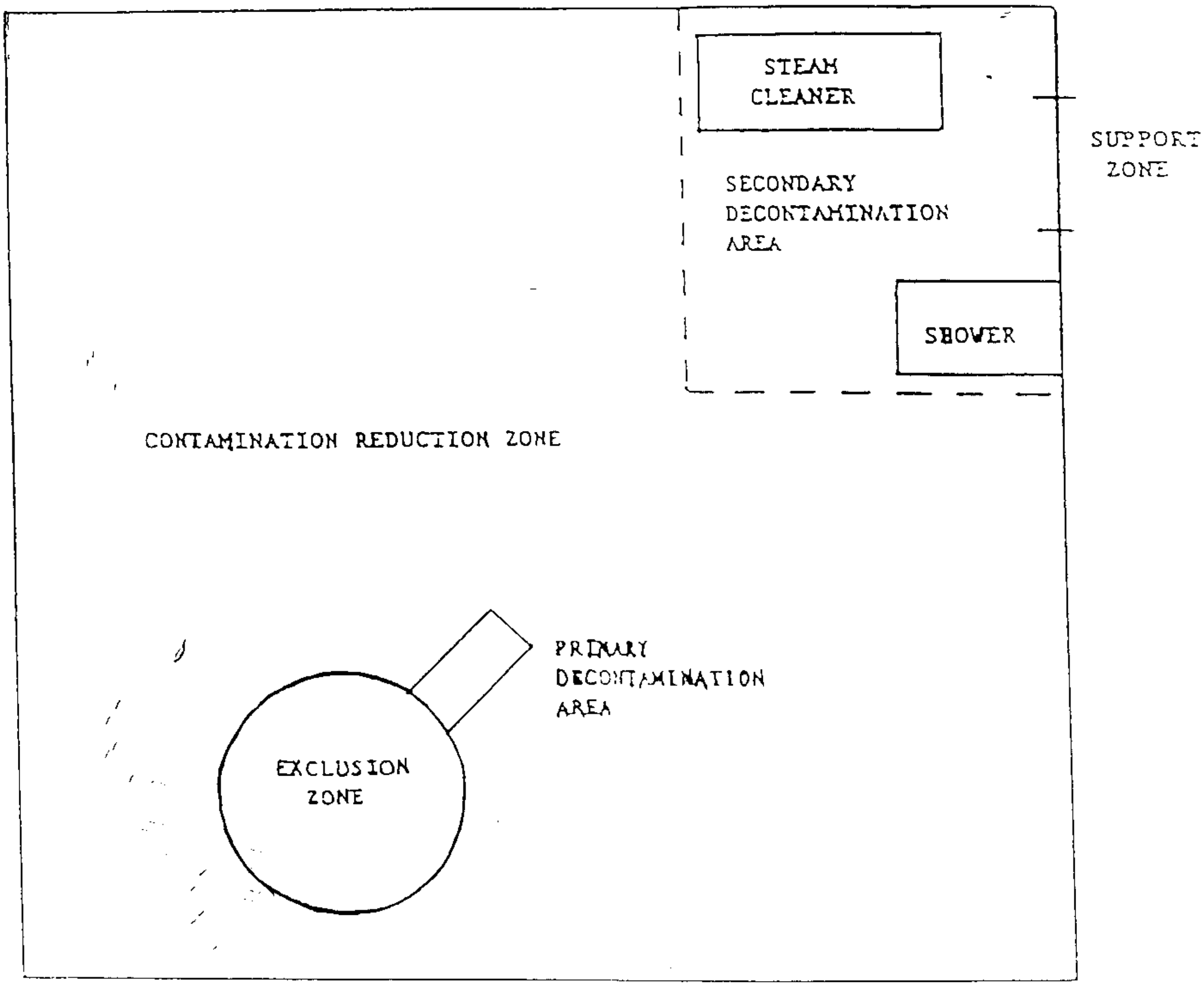
d. Additional decontamination between work locations may be required by the sampling plan.

e. Disposable equipment which will not be decontaminated will be containerized for disposal.

f. Decontamination fluids will be permitted to infiltrate the soils surrounding the areas of intrusive activity.

Figure SSHP-B1 Typical Layout of Decontamination Facilities

Figure SSHP-B1 Typical Layout of Decontamination Facilities



APPENDIX C

ENVIRONMENTAL STRESS

1. **Heat Stress**

a. Heat stress injuries can easily occur when clothing (especially protective clothing) impairs the body's cooling capacity, the internal body temperature rises, and the normal thirst mechanism is not adequate to bring about fluid replacement that is lost through sweat.

b. When body temperatures taken at the beginning of a rest period indicate temperatures exceeding 99.6 degrees F (37.6 degrees C), the next work cycle should be shortened by 1/3. Another indication of rising internal temperatures is the heart rate. Heart rates can be obtained by counting the radial pulse during a 30 second period (and double it) as early as possible in a work period. If the heart rate exceeds 110 beats per minute shorten the following work cycle by 1/3.

c. The symptoms of heat stress in order of increasing severity include:

(1) Heat Cramps (inadequate fluid replacement)

- (i) muscle spasms
- (ii) pain in hands and feet

(2) Heat Exhaustion (inadequate blood circulation)

- (i) pale, cool, moist skin
- (ii) heavy sweating
- (iii) dizziness
- (iv) nausea
- (v) fainting

(3) Heat Stroke

- (i) red, hot, usually dry skin
- (ii) lack of or reduced sweating
- (iii) nausea
- (iv) dizziness and confusion
- (v) strong, rapid pulse
- (vi) coma

d. Heat stress first aid includes:

(1) Heat Cramps

- (i) Replace fluids
- (ii) Monitor for additional symptoms

(2) Heat Exhaustion

- (i) Move person to cool place
- (ii) Rest with feet elevated

(iii) Give water in small amounts

(iv) Recovery is usually rapid, if not emergency medical treatment is necessary.

(3) Heat Stroke

(i) Cool body immediately with cool water or cold compresses

(ii) Call ambulance immediately

(iii) Continue cooling until ambulance arrives

e. Heat stress prevention includes:

(1) Adjusting work hours during the coolest hours;

(2) Scheduled rest periods;

(3) Maintaining body fluids at normal levels by consuming small drinks of moderate temperature every 15 to 20 minutes.

f. Since the ACGIH TLV work/rest schedule is designed for use with ordinary work clothes and not impermeable PPE, and a Wet Bulb Globe Temperature (WBGT) meter may not be available, the following modified schedule will be used to accommodate the PPE. If PPE is not being utilized, 10° F should be added to the temperature schedule below.

(1) On a <u>cloudy</u> day, continuous work may be performed below 70°F. Above this temperatures be aware of heat stress and use buddy system and guidelines below.

75% work / 25% rest each hour at air temperature 70-79°F
50% work / 50% rest each hour at air temperature 79-85°F
25% work / 75% rest each hour at air temperature above 85°F

(2) At temperatures above 85°F everyone should have their heart rate measurements taken at 30 minute intervals stop work in PPE when heart rate reaches 120 beats per minute. This schedule is conservative and if one is under a light work load the work periods can be extended. If under a heavy work load or a sunny day the rest periods can be extended.

(3) Note: Work shall cease at a shaded dry bulb temperature of 98 degrees F.

(4) Each employee should be aware of their own heart rate. If, between work periods, one feels their heart rate (pulse) may be greater that 120 beats per minute, STOP WORK, notify SSO, go to a shaded area, take heart rate and, if necessary, REST.

2. **<u>Cold Stress</u>**

a. For exposed skin, continuous exposure shall not be permitted when air speed and temperature results in an equivalent chill temperature of -15°F. The ACGIH wind chill chart is presented in Tables SSHP-C1 and SSHP-C2.

b. At air temperatures of 35°F or less, it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately provided a change of clothing, and be treated for hypothermia. At temperatures below windchill equivalents of -15°F the following work warm up schedule shall be implemented.

c. Cold stress of hypothermia occurs when the body's core temperature falls below 36°C (96.8°F). Pain in the extremities is the first sign of overexposure. Maximum severe shivering develops when the body temperature fall to 95°F. This is a sign of danger and exposure to cold should immediately be terminated. The symptoms of hypothermia are presented at Table SSHP-C3.

Table SSHP-C1 Wind Chill Chart

Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-28	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind Speeds >40 mph have little additional effect.)	*LITTLE DANGER* In <1 hour with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of expose flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds			
	Trenchfoot and immersion foot may occur at any point on this chart.											

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA

Table SSHP-C2 Cold Stress TLV Chart

Threshold Limit Values Work/Warm-up Schedule for Four Hour Shift*

Air Temperature-Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.	°F	Max. Work Period	No. of Breaks	Max. Wor Period	No. of Breaks	Max Work Period	No. of Breaks	Max. Wor Period	No. of Breaks	Max Work Period	No. of Breaks
-26 to -28	-15 to 19	(Normal breaks) 1		(Normal Breaks) 1		75 min	2	55 min	3	40 min	4
-29 to -31	-20 to 24	(Normal Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	-25 to 29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency wor shall cease.	
-35 to -37	-30 to 34	55 min	3	40 min	4	30 min	5	Non-emergency wor shall cease.			
-38 to -39	-35 to 39	40 min	4	30 min	5	Non-emergency wor shall cease.					
-40 to -42	-40 to 44	30 min	5	Non-emergency wor shall cease							
-43 & below	-45 & below	Non-emergency work shall cease									

Notes:
1. Schedule applies to moderate to heavy work activity with warm-up breaks of ten(10) minutes in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example at -30°F with no noticeable wind (step 4), a worker at a job with little physical movement should have a maximum of work period of 40 minutes with 4 breaks in a 4-hour period (step 5).
2. The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph-light flag moves; 10 mph-light flag fully extended; 15 mph-raises newspaper sheet; 20 mph-blowing and drifting snow.

Table SSHP-C3 Progressive Clinical Presentations of Hypothermia

Table SSHP-C3 Progressive Clinical Presentations of Hypothermia